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## MOSQUITOES TRANSPORTED BY AIRPLANES Staining Method Used in Determining their Importation

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### INTRODUCTION

The possible importance of the aerial transportation of mosquitoes, particularly *Aedes aegypti*, has been a matter of serious interest to public health officials for several years. With steady increase in passenger traffic by air, the establishment of airlines connecting practically all countries, and the ever increasing speed with which air travel is being accomplished, more and more have we become concerned with the public health aspect of air transport service. Soon after assuming charge of the Miami (Fla.) quarantine station, Surg. Carl Michel, medical officer in charge of the station, became interested in the question as to whether airplanes landing at Miami from tropical ports were carrying mosquitoes. Doctor Michel expressed the belief that mosquitoes were carried by airplanes.

For the purpose of determining whether or not mosquitoes are carried in airplanes, and, if so, to what extent, the distance of such transportation, the species of mosquitoes, and the types of planes on which they are carried, the United States Public Health Service began, on July 23, 1931, the inspection of all airplanes from tropical ports arriving at the airports of the Pan American Airways System at Miami. Officials of the Pan American Airways System readily and fully cooperated in the undertaking. This paper covers the period of airplane inspection from July 23 to September 18, including experiments with stained specimens of *Aedes aegypti* placed on planes at San Juan, P. R., destined for Miami, Fla.

### TYPES OF AIRPLANES OPERATING FROM AND TO MIAMI

There are three types of airplanes now operated, by the Caribbean division, Pan American Airways System, between Miami and ports in Cuba, Haiti, Dominican Republic, Porto Rico, South America (Colombia), Panama, Salvador, British Honduras, Honduras, Yucatan, and Jamaica. These are trimotor Fokkers, Sikorsky amphibians, and Commodores.

## INSPECTION OF AIRPLANES FOR MOSQUITOES

Planes were boarded immediately after they had landed and discharged crews, passengers, baggage, and mail. Whenever practicable, doors, windows, and hatches were closed promptly to prevent the escape of mosquitoes. At first, the ordinary "chloroform tube"<sup>1</sup> was used, but later this was supplanted by a power-suction collector<sup>2</sup> devised by the senior writer. The windows, ceiling, and walls were first examined. Then a folded paper was used to brush under the seats, radio desk, and other protected places to drive out any resting mosquitoes. After the cabin had been examined, the cockpit, front and rear baggage compartments, rear fuselage, etc., were thoroughly inspected.

## MOSQUITOES CAUGHT IN AIRPLANES

From July 23 to September 12, 1931, 102 inspections of arriving airplanes were made at Miami airports. Of these, 72 were Fokker trimotor planes from Habana (daily) and San Juan (triweekly); 16 were Sikorsky amphibians from Central America and Mexico (via Habana), and 14 were Commodores from Panama, Colombia, and Jamaica (via Cienfuegos). In all 29 mosquitoes (1 male *Aedes aegypti* and 28 *Culex quinquefasciatus*)<sup>3</sup> were captured, 24 on the Sikorsky amphibian (majority in front baggage compartment), 1 on a Fokker (from Habana), and 4 on the DO-X. Notwithstanding the fact that the Commodore planes offer better protection for mosquitoes, none was found on them. (This may have been due to the lack of mosquito prevalence at landing fields, or to the practice of spraying these ships for mosquito destruction at ports where overnight stops are made.)

PROCEDURE IN EXPERIMENT WITH STAINED *AEDES AEGYPTI* IN AIRPLANES

In order to conduct exact experiments to determine, if possible, the distance mosquitoes may be carried by airplanes, the United States Public Health Service made arrangements with the Pan

<sup>1</sup> This is made in the usual way with a plug of rubber bands in bottom of tube, a wad of cotton and cork disk above (the latter not coming in contact with the chloroform-soaked cotton and rubber bands).

<sup>2</sup> This apparatus consists of a small vacuum cleaner (60 cycle, 110 volt, 100-watt, alternating or direct current) with brush removed from the suction end and rubber tubing attached (about 12 feet length). To the far end of the tubing is attached a celluloid collecting tube, with cork truncated cone fixed in the distal end and the rubber tube inserted in the back end through a perforated cork, the end of the rubber tubing being screened with a piece of gauze to prevent sucking the mosquitoes through the rubber tubing and into the machine. This has been found to be an efficient and rapid method for mosquito collecting, not only on airplanes but in general, in field investigations of malaria. By using as long a lead wire as required, the suction apparatus is simply plugged into an electric light or power socket, or into the socket of a home-light generator.

<sup>3</sup> Since September 18, representatives of the following additional species of mosquitoes have been found in the routine inspections of airplanes at Miami: *Mansonia titillans*, *Aedes taeniorhynchus*, and *Anopheles albimanus*.

American Airways System whereby permission was given to liberate stained mosquitoes in planes at a selected airport, or airports, on the routes of the Caribbean division of the system. All plans having been made and equipment assembled, the senior writer proceeded from Miami to San Juan, P. R., by airplane, September 9, 1931. Not knowing how long the experiments might have to be continued, it was tentatively planned to put aboard at San Juan, mosquitoes stained with eosin, and others stained with aniline blue, at Port au Prince. The results from the first "cargo" were so strikingly positive that there was no necessity or advisability of conducting an experiment from the nearer port, Port au Prince.

As *Aedes aegypti* are the mosquitoes with which we are most concerned in connection with aerial traffic, many hundreds of larvae and pupae of this species were collected (from a single container) in San Juan the day of arrival. Over the jar containing the larvae and pupae was placed a cage 12 inches by 8 inches by 8 inches. This was made with a framework of insulated copper wire, covered with a coarse mesh, cotton gauze. The larvae container was covered with gauze, with a hole cut in the center through which the mosquitoes came into the cage soon after emergence. When it was desired to remove the cage, the holes in the cage and in the larvae container cover were plugged with absorbent cotton. Within 3 or 4 days an abundant supply of adult *Aedes aegypti* (with a small number of *Culex quinquefasciatus*) had emerged. These fed freely on raisins before being stained and placed on planes.

#### TECHNIQUE OF STAINING MOSQUITOES

The stain used was a 2 per cent aqueous solution of eosin (yellowish, water-soluble). The cage of mosquitoes (about 40 specimens) was hung about the level of the shoulders, and by the use of an atomizer the stain was sprayed against the cage, enough going through the mesh of the gauze to color most of the specimens. Approximately 20 c. c. of the dilute stain was used, and the staining was accomplished in two or three minutes' time. Care was exercised that the atomizer was held at least 18 inches away from the cage, to allow the heavier droplets to fall before reaching the specimens. If the specimens are sprayed to excess, many will die or become incapacitated for a reliable test. This, quite obviously, may result in not securing the staining of some of the specimens. However, one may be fairly assured of effective staining of a batch of mosquitoes within two or three minutes if the mesh of the gauze is not very fine and is stretched tightly over the frame.

## RECOGNITION OF STAINED MOSQUITOES

The recognition of stained specimens does not depend upon seeing the stain on the recovered insect. In this experiment a *solvent* for the stain, composed of the following, was employed:

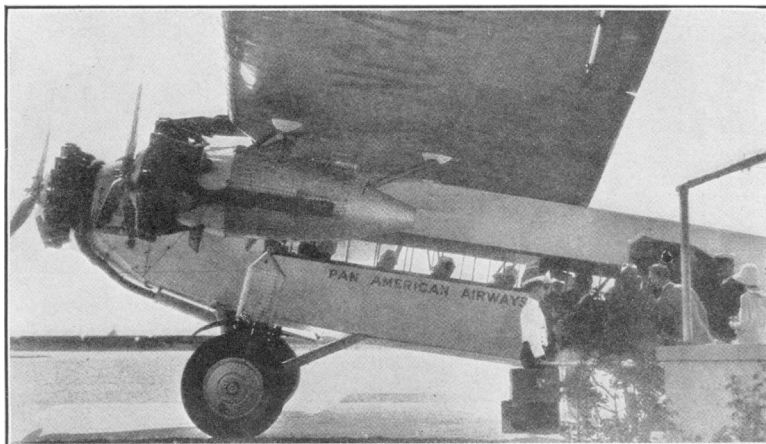
Glycerine.....	4 parts
Absolute alcohol.....	4 parts
Ether.....	1 part

After being mixed and standing for a few minutes a clear solution results.

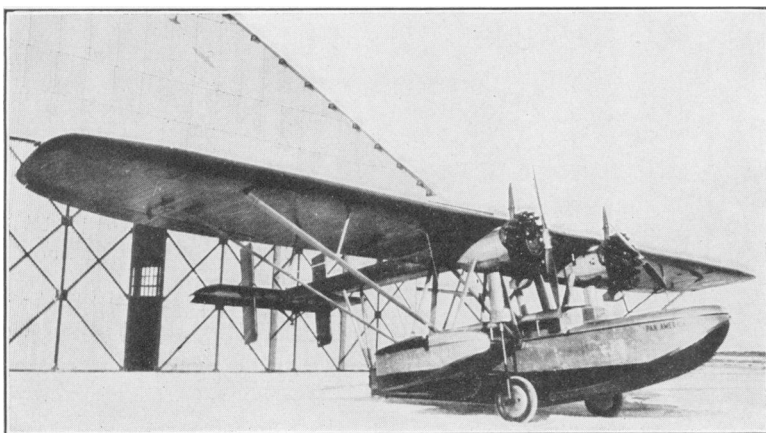
The captured mosquitoes were killed by exposure to vapor of chloroform and placed on a glass plate, or microscopic slide, with white paper beneath. A drop of the solvent was dropped on the mosquito, care being taken that the legs, wings, and all other parts were brought into the drop of solvent. (More than a good sized drop should not be used, as the dilution may render the reaction questionable in weakly stained specimens.) In freely stained mosquitoes the whole drop soon assumed a yellowish eosin color. Even a small amount of stain on a leg or other part gave a reddish-yellow tinge to the drop of solvent. This color will remain for several hours; but should the mosquito have had a blood meal, the blood will be dissolved after a few hours and this consequently, will be confusing.

## RESULTS OF STAINED-MOSQUITO EXPERIMENTS

The first experiment with stained mosquitoes to determine whether they were transported by airplane was conducted at San Juan, P. R., September 13, 1931. Approximately 40 mosquitoes, practically all *Aedes aegypti* (males and females) were subjected to stain from an atomizer at 5 a. m.; 40 minutes later all were released in the cockpit, cabin, and rear compartments of trimotor Fokker cabin plane No. 396-E which left San Juan four minutes later for Miami, Fla. The first landing was at Santo Domingo, Dominican Republic, 3 hours and 15 minutes after leaving San Juan. Here the ship discharged and took on passengers, baggage, and mail, and departed. (At airport 18 minutes.) The next landing was at Port au Prince, Haiti, 2 hours and 32 minutes after leaving Santo Domingo. Here the plane discharged and loaded passengers, mail, and baggage, departing after remaining at the airport 21 minutes. The time of flight to Camaguey, Cuba, was 3 hours and 16 minutes. At Camaguey the crew and passengers again left the plane and mail and baggage were exchanged. The plane left Camaguey at 1.08 p. m., and landed at Miami, Fla., 2 hours and 29 minutes later. The air distance covered was 1,250 miles, in 9 hours and 53 minutes, with three stops aggregating 1 hour and 9 minutes. Thirteen mosquitoes were recovered from the plane



Passengers boarding tri-motor Fokker airliner



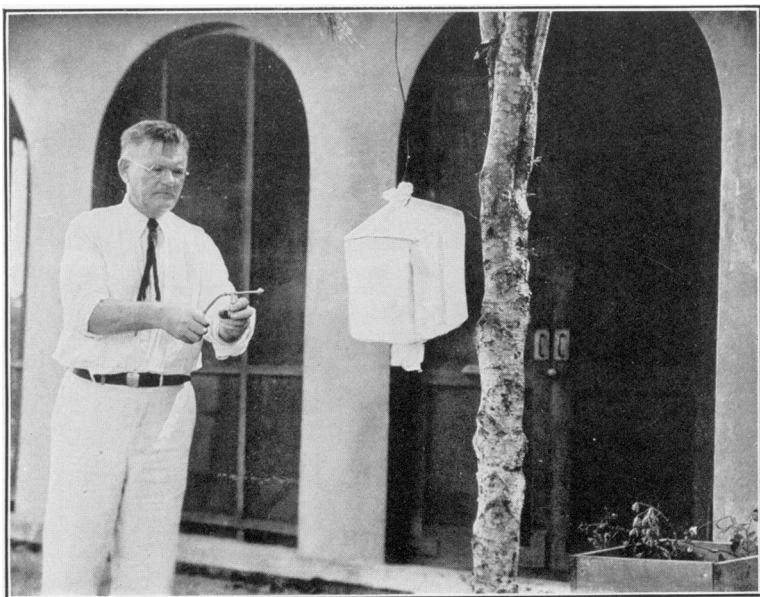
Sikorsky amphibian, operating between Miami, Central America, and Mexican ports



Commodore airliner (hydroplane), operating between eastern South American ports and San Juan, P. R., and between Miami and the Canal Zone, Colombia, Jamaica, and Cuba



Electric motor suction device for collecting mosquitoes



Staining mosquitoes before liberating them on airplanes

after landing at Miami (10 in the cabin and 3 in the rear fuselage). There were 10 *Aedes aegypti* (4 males and 6 females), 2 *Culex quinquefasciatus*, and 1 unidentified specimen. Four of the *Aedes aegypti*, when covered with the solvent, gave strong stain reaction.

On September 16, the experiment was repeated, with 30 stained specimens placed in the various compartments of the trimotor Fokker No. 9701, leaving San Juan at 5.40 a. m., and arriving at Miami at 3.50 p. m., after making the regular stops at Santo Domingo, Port au Prince, and Camaguey. Time of flight 10 hours and 10 minutes. Three of these specimens (two *Aedes aegypti* and one *Culex*) were recovered on arrival at Miami. One of us (T. H. D.) was a passenger on this plane from San Juan to Port au Prince, and observed only one mosquito active on the plane during the trip. This mosquito bit the radio operator on the face when we were at an elevation of about 3,000 feet.

A third batch of stained mosquitoes was left at San Juan, and these were released on the plane leaving San Juan on the morning of September 18. One of the writers (T. H. D.) boarded this plane at Port au Prince at 9.55 a. m. and arrived at Miami at 4.06 p. m., having made one stop, 20 minutes, at Camaguey, Cuba. No mosquitoes were observed *en route*, although one of the pilots reported that he was bitten while in flight. Upon landing at Miami, two *Aedes aegypti* immediately came from under the seat and attempted to bite. These two and three others were caught in the cabin and one was captured in the rear fuselage, making a total of six mosquitoes (all *Aedes aegypti*) carried through on this plane from San Juan, P. R., to Miami, Fla. This airplane left San Juan at 5.34 a. m. and arrived at Miami at 4.06 p. m., stopping at Santo Domingo 22 minutes, Port au Prince 44 minutes, and Camaguey 20 minutes. The total time for the trip was 10 hours and 32 minutes, the flying time being 9 hours and 6 minutes, and time spent at intermediate airports, 1 hour and 26 minutes. The length of time that a plane remains at an airport may be important, inasmuch as the door to the cabin remains open, the crew and passengers leave the plane, and the baggage and mail are discharged and loaded, offering ample opportunity for mosquitoes to make their exit. However, *Aedes aegypti* do not lead an out-door life, and, therefore, show a marked tendency to remain within inclosures.

#### SUMMARY

(1) Of the three types of passenger-carrying airplanes now operating round trips between Miami, Fla., and the West Indies, western coast of South America, Central America, Panama, Mexico, and Jamaica, the Commodore is physically best suited for carrying mosquitoes in the cabin; but, due to regular spraying with an insecticide or to lack of

mosquito prevalence at ports of départure, or call, no mosquitoes were found aboard these ships. The front baggage compartment of the Sikorsky amphibian is ideal for harboring mosquitoes. A large majority of the mosquitoes not intentionally placed on planes, in experimental work, were found in this compartment.

(2) One hundred and two inspections of airplanes arriving at Miami from foreign and insular airports were made from July 23 to September 12, 1931, and of this number 21, or 20.5 per cent, carried mosquitoes. In all, 29 mosquitoes were captured, 24 of which were taken on Sikorsky amphibian planes. Of these mosquitoes 28 were *Culex* and one was *Aedes aegypti*.

(3) *Aedes aegypti* (with a few *Culex quinquefasciatus*) numbering approximately 100, were developed from collected larvae and pupae, stained with a 2 per cent watery solution of yellowish eosin by means of an atomizer, then liberated on planes leaving San Juan, P. R., on September 13, 16, and 18, 1931. Of the 100 specimens put aboard on these three dates, 22 specimens were recovered at Miami, Fla., 1,250 miles distant, on the afternoons of the days of departure. The average time of these air trips was 10 hours and 10 minutes, 1 hour and 10 minutes of which were spent at intermediate landing fields. Eleven of the 22 recovered specimens showed strongly positive reactions to the stain solvent. The fact that not a single mosquito had been caught on the tri-motor Fokker planes arriving at Miami from San Juan from July 23 through September 12, and that 13 were caught on September 13, 3 on the 16th and 6 on the 18th, the only dates when mosquitoes were placed aboard, is strong enough evidence of their coming through even though only 50 per cent of them reacted to the stain solvent (glycerine 4 parts, absolute alcohol 4 parts, ether 1 part) after being recaptured.

(4) One mosquito was observed biting during flight of the plane on September 16, 1931, and at approximately 3,000 feet altitude over Dominican mountains.

#### CONCLUSIONS

That certain types of airplanes carry mosquitoes (particularly *Aedes aegypti* and *Culex quinquefasciatus*) has been proved. With conditions at airports such as would permit of many mosquitoes getting aboard, it might be expected that approximately one-fifth of the original number would be transported for a long distance—at least 1,250 miles—in one day, with repeated landing and the opening of doors, hatches and windows, and refueling, unloading, and loading taking place. Under average natural mosquito production conditions about airports, heavy infestation of aircraft (like the "loading" of planes in these experiments) would not be expected and, consequently, mosquitoes in only small numbers would make the trip.



However, even one infected, or infective, *Aedes aegypti* might be the means of starting an epidemic. Notwithstanding the fact that airplanes may, or do, transport mosquitoes, this mode of introduction of mosquito-borne disease is probably secondary in importance to the importation of infected man.

With the relatively small number of mosquitoes carried by aircraft and the facility with which airplanes may be freed from mosquitoes at ports of departure, it may safely be concluded that, while there is a recognized potential danger, there is no obstacle to the efficient treatment of airplanes so as to destroy mosquitoes and avoid retardation of air traffic progress.

#### ACKNOWLEDGMENTS

Grateful acknowledgment of indebtedness, in connection with these studies, is extended to Mr. R. I. Dunten and all other officials and employees of the Pan American Airways System, who so courteously and fully cooperated, and to Surgeon L. E. Hooper, Surgeon Carl Michel, and Acting Assistant Surgeon J. Acosta Velarde, United States Public Health Service.

#### Appendix

*Fokker tri-motor cabin planes*, making three round-trips per week, operate between Miami and San Juan, P. R., stopping at Camaguey, Cuba, Port au Prince, Haiti, Santo Domingo, R. D. (stopping overnight here on the eastern trip) and arriving at San Juan the next morning about 8 o'clock. The return trip to Miami is made in one day. The Fokker is equipped for carrying 10 passengers, pilot and copilot, radio operator and steward. The cabin of the Fokker offers little disturbance in flight to mosquitoes. They may rest under the passengers' seats, the radio operator's desk, under the pilots' seats in the cockpit (more draft here than in the cabin), and especially may they be carried in the space of the back fuselage, which is occupied only by a net-work of metal trusses. At the forward part of the back fuselage is the baggage compartment, and here there is good protection from strong air currents. The toilet compartment between the baggage space and the cabin also may harbor mosquitoes.

*Sikorsky amphibian passenger planes* make round-trips between Miami and San Salvador, stopping *en route* at Tela, Belize, Cozumel, and Habana (over-night stop at Habana on the north bound trip). This plane is equipped for carrying eight passengers, pilot, copilot, radio operator, and steward. The cabin of this type of plane is generally subjected to more air draft in flight than either the Fokker or Commodore, but mosquitoes may be carried in the cabin. The front baggage compartment in the nose of the ship is closed in flight and free from air currents. It offers ideal conditions for resting

mosquitoes. A large percentage of those caught in the Miami routine inspections have been found in this compartment. Back of the cabin is a small compartment for toilet and radio equipment. This and the back fuselage space offer fair conditions for the carrying of mosquitoes.

*Commodore cabin planes* operate between Miami and Cristobal, C. Z., stopping at Baranquilla, Colombia, Kingston, Jamaica (overnight), and Cienfuegos, Cuba, on the north bound flight. The Commodore is a large seaplane equipped for carrying 21 passengers, pilot, copilot, steward, and radio operator. The cabin is divided into four sections, the rear two sections exclusively for passengers, the front two sections for the radio operator and steward and for baggage. The steward's seat and table are well protected from draft, but the radio operator's section is under the front hatch, exposed to draft when the hatch is open in flight. The cabin of this type of plane offers ample resting places for mosquitoes. This is particularly true of the spaces under the seats to which mosquitoes have easy access, and complete freedom from disturbing air currents. Mosquitoes may also rest in the three spaces in the back fuselage which are dark, not loaded, and wholly protected from draft.

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## LEPROSY

### A STUDY OF THE WHITE BLOOD CELLS AND THEIR RELATION TO CLINICAL PROGRESS<sup>1</sup>

By L. F. BADGER, *Passed Assistant Surgeon, United States Public Health Service, Leprosy Investigation Station, Honolulu, T. H.*

The knowledge of the cellular constituents of blood in normal individuals corresponding to the abnormal group studied is essential for the interpretation of the blood picture in diseased conditions. There is available no report on the white blood cell picture in normal residents of the Hawaiian Islands; therefore it is necessary to compare the results obtained in the group of lepers in this study with the so-called normal blood picture. In spite of the enormous amount of work done, there still lacks unanimity regarding the normal blood cell findings.

#### NORMAL NUMBERS OF WHITE BLOOD CELLS

In considering the normal white blood cell picture, the question arises what, if any, is the effect of race, climate, altitude, and age on the number of the various white blood cells in the circulating blood. If these factors affect the blood picture, they must be considered in the study of the white cellular constitution of the blood of lepers.

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<sup>1</sup> Submitted for publication Oct. 1, 1929.

Before discussing the results of this study, these various factors will be considered briefly.

The group of lepers on which this report is based was composed of Hawaiians, Japanese, Chinese, Filipinos, Portuguese, and various mixtures of these races, 60 per cent being Hawaiian or part Hawaiian. They lived on the Hawaiian group of islands situated at approximately 20° north latitude, in a subtropical climate, and at sea level. Ninety-two per cent were over 15 years of age and none was under 10 years.

*Race.*—Fisher and Tsung (1) examined the blood of 75 healthy Chinese medical students. From a comparison of their results with those of Schilling, in Europe, and Miller, in North America, they concluded that the lymphocytes are increased in Chinese.

Chamberlain and Vedder (2) concluded from their study that the neutrophilic leucocytes are decreased and the lymphocytes are increased in normal Filipinos living in a tropical climate. Their results were approximately the same as those of Fisher and Tsung for Chinese in Shanghai.

Kop (3) examined 55 Europeans and 38 natives in Java and found a difference only in the number of eosinophiles, which were more numerous in the natives. He stated that the increase in the number of the eosinophiles was satisfactorily explained by the higher rate of infection with intestinal worms in the natives.

Mehrtens (4), in San Francisco, Wallace (5), in Tampa, Fla., and Fairley (6), in Melbourne, Australia, have found results in normal whites strikingly similar to those obtained by Fisher and Tsung in Chinese and Chamberlain and Vedder in the Filipinos.

TABLE 1.—*Neutrophilic, lymphocytic, and monocytic percentages on Chinese, Filipinos, and whites*

Observer	Race	Per cent of neutrophiles	Per cent of lymphocytes	Per cent of monocytes
Fisher and Tsung (1).....	Chinese.....	53.5	35.3	6.1
Chamberlain and Vedder (2).....	Filipinos.....	56.8	31.7	6.9
Mehrtens (4).....	White.....	56.5	37.5	4.5
Wallace (5).....	do.....	54.6	38.8	3.7
Fairley (6).....	do.....	54.5	39.1	4.5

More conclusive evidence of the relation of race to the white blood cell picture is obtained when different racial groups, under the same conditions, are compared. A comparison of 1,500 counts on white and 300 on colored patients in the same hospital (Table 2) shows approximately the same counts. Likewise, the blood counts on 72 whites and 50 Filipinos living in the Philippine Islands (Table 2) are approximately the same.

TABLE 2.—*Neutrophilic, lymphocytic, and monocytic percentages in different racial groups under the same conditions*

Observer	Race	Per cent of neutrophiles	Per cent of lymphocytes	Per cent of monocytes
Lippincott (7).....	{White.....	61.85	30.6	6.5
	{Colored.....	60.95	33.5	4.9
Chamberlain and Vedder (2).....	{White.....	56.8	31.7	6.9
	{Filipinos.....	52.2	29.9	6.6

*Climate.*—It is believed by some investigators that the white blood cell picture varies with the climate. Wickline (8), from a study of the blood of American soldiers in the Philippines, concluded that the neutrophilic leucocytes are decreased and the lymphocytes are increased in the Tropics. His first examinations were made six months, and the third, or last, 22 months after the troops had arrived in the islands. In Table 3 are shown the changes which he observed.

TABLE 3.—*The effect of residence in the tropics on the neutrophiles and lymphocytes as observed by Wickline*

Type of cell	After 6 months' residence; 104 men—average per cent	After 14 months' residence; 97 men—average per cent	After 22 months' residence; 81 men—average per cent
Neutrophiles.....	64.43	60.04	54.87
Lymphocytes.....	21.80	26.61	33.38

Definite conclusions can not be drawn from this study, because 22 per cent of the men of the first examination were not included in the last examination. The report would have been more instructive if the blood cell counts of only the 81 men of the last examination were included for comparison. Wickline also stated that there occurred an increase in the eosinophiles, running up to 40 per cent, and that he believed this increase was due to parasitic skin diseases or intestinal parasites. Such cases should have been excluded from the study, as such increases in the relative number of eosinophiles would alter the relative number of neutrophiles and lymphocytes.

Chamberlain and Vedder (2) concluded from their study on 72 Americans and 50 Filipinos that the neutrophiles decreased and the lymphocytes increased as a result of residence in the Tropics.

Kop (3) concluded from his study of the blood counts of 55 Europeans and 38 natives in Java that the cellular constitution of the blood of normal persons living in the Tropics is essentially identical with that observed in healthy persons dwelling in temperate climates.

Remarkable similarity in the percentages of the neutrophiles, lymphocytes, and the monocytes have been obtained, by various observers, in the blood of normal individuals living under widely varying climatic conditions (Table 4).

TABLE 4.—*Relative number of neutrophiles, lymphocytes, and monocytes in the blood of normal adults in various climates*

Observer	Place	Number examined	Per cent neutrophiles	Per cent lymphocytes	Per cent monocytes
Wickline (8).....	Philippines.....	104	54.87	33.38	6.15
Wallace (5).....	South Florida.....	40	54.6	38.8	3.7
Fairley (6).....	Melbourne.....	29	54.5	39.1	4.5
Sweet (9).....	Brisbane.....	188	58.9	30.6	5.5
Fisher and Tsung (1).....	Shanghai.....	75	53.5	35.3	6.1
Mehrtens (4).....	San Francisco.....	100	56.5	37.5	4.5
Stains et al. (10).....	Colorado Springs.....	100	54.5	36.0	7.0
Bunting (11).....	Wisconsin.....	25	50.60	30.40	6.10
Shaw (12).....	England.....	116	53.2	36.8	6.7

*Altitude.*—Stains, Jones, and Rosenberg (10) concluded, from the comparison of the blood counts on 100 medical students in New York City, and 100 in Colorado Springs, that at an elevation of 6,000 feet there occurs an increase in the lymphocytes and a decrease in the neutrophiles. Table 4 reveals the fact that their results obtained at the higher altitude were not unlike those obtained at various elevations in widely separated localities. In order to draw conclusions as to the effect of altitude on the blood pictures, the same group of individuals should be examined at varying elevations. No such report is available.

*Age.*—That the white blood cell picture varies to a certain extent with age is an accepted fact. The blood picture of a child is not that of an adult, but the age at which the adult percentages of the white cells occur is debated. It has been variously reported as from 6 years to puberty.

From this brief discussion it may be stated that we have as yet no conclusive evidence that the white blood cell picture varies with race, climate, and altitude; and until such evidence is obtained, these factors may be disregarded in the determination of the effect of a disease process on the white blood cell picture.

What then are the normal numbers of the white blood cells in healthy adults? The normal number of the leucocytes as given in some of the standard textbooks are shown in Table 5.

TABLE 5.—*The normal white blood-cell picture as given in standard textbooks*

Author	Total number of leucocytes	Neutrophiles	Lymphocytes	Monocytes	Eosinophiles	Mast cells
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Emerson (15) .....	-----	70-72	22-25	2-4	2-4	0.5
Simon (16) .....	-----	60-70	20-30	1-6	1-4	.2-1
Green (17) .....	-----	70 (60-75)	20 (20-25)	7-9	4 (0.5-5)	.1-0.5
Starling (18) .....	-----	70	23	2-3	2-4	.5
Stohr & Lewis (19) .....	-----	70-72	22-25	1-3	2-4	.5
Wright (20) .....	8,000	60-70	20-25	4-8	2-4	.5
Stitt (21) .....	7,000-10,000	65-75	22-36	3-6	1-2	.25-0.5
Schilling (22) .....	6,000-8,000	67 (54-73)	23 (21-35)	6 (4-8)	3 (2-4)	.5 (0-1)

The usually accepted standard is about as follows: Total leucocytes 5,000 to 10,000; neutrophiles 60 to 75 per cent; lymphocytes 20 to 30 per cent; monocytes 2 to 8 per cent; eosinophiles 1 to 4 per cent; and mast cells 0 to 0.5 per cent.

Recent reports of investigators in different parts of the world have given evidence that these numbers should no longer be accepted as normal. The percentage of neutrophiles is given as too high, that of the lymphocytes too low, and the variation of these cells not sufficiently great.

Sabin et al. (13) found in a normal individual a variation in the total number of leucocytes during 12 hours of from 7,200 to 13,680; in the neutrophiles from 37 to 60 per cent, and in the lymphocytes from 19 to 45 per cent.

Shaw (12) on the examination of 116 normal adults found the total number of white cells to vary from 3,200 to 9,650, and the neutrophiles from 37 to 69.8 per cent, and the lymphocytes from 22 to 51.2 per cent.

Mauriac and Cabouat (14) found the variation in the number of neutrophiles from 47 to 73 per cent.

Four reports on groups of adult hospital cases (Table 6) suffering, as far as could be determined, from no inflammatory process, show the average percentages of neutrophiles to be that of the generally accepted minimum per cent of that cell and the average percentages of the lymphocytes to be that of the generally accepted maximum per cent of that cell.

TABLE 6.—*The percentages of neutrophiles, lymphocytes, and monocytes in adult hospital cases suffering with no inflammatory process*

Observer	Number of cases	Per cent of neutrophiles	Per cent of lymphocytes	Per cent of monocytes
Lippincott (7) .....	1,500 (counts) .....	61.85	30.6	6.5
Do .....	300 (counts) .....	60.95	33.5	4.9
Wallace (5) .....	100 (cases) .....	60.0	33.3	4.1
Sweet (8) .....	188 (cases) .....	58.9	30.6	5.5

In Table 7 are shown the average percentages of the different types of the white cells obtained on normal adults by various observers of widely separated sections of the world. It will be noted that these percentages vary from those generally accepted as normal.

TABLE 7.—*The relative numbers of white blood cells on normal adults in widely separated sections of the world*

Observer	Place	Number exam- ined	Neutro- philes	Lym- pho- cytes	Mono- cytes	Eosino- philes	Mast cells
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Wallace (5).....	South Florida.....	40	54.6	38.8	3.7	1.1	1.8
Roberts (23).....	South Africa.....	150	42.5	38.8	12.7	5.1	.23
Connal (24).....	West Africa.....	722	44.9	29.1	18.2	7.2	0.
Mehrtens (4).....	San Francisco.....	100	56.5	37.5	4.57	.97	.52
Chamberlain and Vedder (2).....	Philippines.....	50	52.2	29.9	4.6	10.6	.7
Do.....	do.....	72	56.8	31.7	6.9	3.8	.8
Fairley (6).....	Australia.....	29	54.5	39.1	4.5	1.5	.4
Bunting (11).....	Wisconsin.....	25	50-60	30-40	6-10	.8-4	.4-1.8
Stains, et al (10).....	New York City.....	100	63	25	9	2.6	.3
Do.....	Colorado Springs.....	100	54.5	36	7	2.5	0.
Miller (25).....	Baltimore.....	230	64.2	22.2	10.8	2.7	.6
Shaw (12).....	England.....	116	53.2	36.8	6.7	2.5	.7
Kop (3).....	Java.....	93	40	50	6	3.5	.5

This brief discussion strongly suggests that our conception of the standard numbers of the white blood cells is not correct and that there is need for studies to determine, as accurately as possible, the normals for healthy adults.

*Leucocyte tide.*—The time of day at which the blood samples are taken is important. Recent investigators have shown that there occurs a marked variation in the total number of white cells and neutrophils during a single day. The relative number of the other types of cells are as a result altered. Sabin and her coworkers (13), in 1925, showed that there occurs a variation in the total number of white blood cells in a proportion of 2 to 1 in the same individual in 12 hours. The maximum number is observed in the afternoon and the entire increase is the result of an increase in the number of the neutrophilic leucocytes. This increase occurs without reference to the intake of food.

Shaw (12), in 1927, found that there occurs a day and a night tide during each 24 hours. The minimum counts occur between 10 and 11 a. m., and 9 and 11 p. m.—the maximum between 2 and 4 p. m., and 2 and 5 a. m. He observed that the neutrophilic curve consistently follows the curve of the total white cells. He also found no evidence, either qualitative or quantitative, for digestive leucocytosis.

Mauriac and Cabouat (14) examined samples of their own bloods and found the percentages of neutrophils to vary from 47 to 73 in one, and 47 to 67 in the other in a single day.

These reports show the necessity in a study of the blood picture in relation to a disease process of making blood counts at a designated time of the day and comparing them with those made at approximately the same time.

#### THE WHITE BLOOD CELL PICTURE IN LEPROSY

It is evident from the review of the literature that but few studies on the blood cytology in leprosy have been made.

Leger (26), 1921, reporting on the blood findings in two cases of leprosy, found the elements practically unaltered. He is of the opinion that leprosy is a disease characterized by a mononuclear increase and by a tendency to the appearance of a moderate eosinophilia from time to time.

Wade (27), in 1926, stated that so far as is known, leprosy presents no very special feature as regards the ordinary laboratory findings, and that "the impression has been gained that the leucocyte counts are not entirely the same as in nonlepers; there seems to be a tendency to higher lymphocyte percentages."

Bargehr (28), 1926, reported on the examination of 130 cases of leprosy. He found that the total white cell count showed but little that is characteristic of the disease. The eosinophiles were increased above normal in 60 per cent of the cases. The neutrophiles were normal in the light cases and increased at the expense of the lymphocytes in the more severe cases.

De Marval (29) concluded from his study of 100 cases that the leucocytes were normal or subnormal; there occurred an eosinophilia, both relative and absolute; no change of importance in neutrophiles and lymphocytes; monocytes showed a mild degree of increase, both relative and absolute.

The study here reported is based on the white blood cell counts of 126 cases of leprosy. The patients were of both sexes and between 10 and 73 years of age, 92 per cent being over 15. Therefore, the group, as far as the blood studies are concerned, may be regarded as composed of adults. All specimens of blood were obtained between 10 and 11.30 in the morning. The differential counts were obtained by counting from 200 to 400 cells. No cases were included which showed evidences of some intercurrent disease. To make the study more instructive, the cases were divided into two groups, one group containing no cases during an acute or subacute leprous reaction, and one group containing cases during such reactions.



## GROUP 1. SEVENTY-FIVE CASES WITHOUT SUBACUTE OR ACUTE REACTIONS

TABLE 8.—White blood cell counts in 75 cases of leprosy not suffering with leprous reactions

	Relative number		Absolute number	
	Average	Variation	Average	Variation
	<i>Per cent</i>	<i>Per cent</i>		
Total leucocytes.....			7,689	5,000-9,800
Neutrophiles.....	51.6	32 -74	4,358	2,050-6,560
Lymphocytes.....	35.9	16.5-58	2,800	950-5,108
Monocytes.....	4.3	1 -12	327	70-984
Eosinophiles.....	2.8	0 -18.5		
Basophiles.....	.3	0 -2.5		

*Total leucocyte count.*—The total numbers of leucocytes in these cases, with an average count of 7,689 and a variation of from 5,000 to 9,800, fall within the normal limits.

*Neutrophiles and lymphocytes.*—If the older standard were accepted for comparison this study would show that the lymphocytes were increased at the expense of the neutrophiles. With our present knowledge all that can be stated is that the numbers of these cells fall within the normal limits with a possible tendency for the neutrophiles more frequently to fall near the lower and the lymphocytes the upper normal limits. Twenty-one and three-tenths per cent of the cases had a percentage of neutrophiles under 50, and 25.3 per cent had a lymphocyte percentage of over 40.

*Monocytes.*<sup>1</sup>—No variation from normal was noted in the number of monocytes in this group of 75 cases. The average was 4.3 per cent, with a variation of 1 to 12. Only 4 per cent of the cases showed more than 8 per cent monocytes.

*Eosinophiles.*—One must bear in mind, in considering eosinophilia and leprosy, that an increase in the eosinophiles occurs in persons infested with various parasites, and that infestation with such parasites is common in many of the communities where leprosy prevails. The average per cent of eosinophiles for the 75 cases here studied was 2.8, with but 7 cases with more than 5 per cent. It may be concluded from this study that leprosy *per se* does not cause an increase in the number of eosinophiles in the circulating blood.

*Basophiles.*—There was nothing of significance noted in the number of basophiles.

<sup>1</sup> The term "monocytes" as employed in this paper includes both large mononuclear and transitional leucocytes.

In order to determine whether any variations in the cell counts were dependent upon the bacteriological findings, type of leprosy, degree of skin involvement, degree of activity, and the administration of chaulmoogra oil, the cases were classified and studied in such groups. The results are shown in Tables 9 and 10.

TABLE 9.—*The total leucocyte counts in various clinical groupings and in relation to bacteriological findings and to chaulmoogra-oil therapy*

	Average of counts	Variation in counts
46 bacteriologically positive.....	7,889	5,200-9,800
29 bacteriologically negative.....	7,337	5,200-9,800
25 dermal.....	7,624	5,200-9,800
25 neural.....	7,400	5,200-9,800
25 with slight skin involvement.....	7,680	5,200-9,800
25 with heavy skin involvement.....	7,644	5,200-9,200
25 clinically active.....	7,984	5,200-9,600
25 clinically quiescent.....	7,720	5,000-9,800
25 receiving chaulmoogra oil.....	7,876	5,000-9,800
26 receiving no chaulmoogra oil.....	7,916	5,800-9,800

TABLE 10.—*Differential white blood cell count in various clinical groupings and in relation to bacteriological findings and to chaulmoogra oil therapy*

	Neutrophils				Lymphocytes				Monocytes			
	Relative per cent		Absolute		Relative per cent		Absolute		Relative per cent		Absolute	
	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average	Range
Total (75 cases)-----	56.1	32-74	4,368	2,059-6,560	35.9	16.5-58	2,800	950-5,108	4.3	1-12	334	70-684
Bacteriological:												
46 positive-----	55.7	37-67	4,392	2,600-6,566	36.9	25-50.5	2,964	1,890-4,747	4.2	1-12	332	70-730
29 negative-----	57.7	35-71.5	4,364	2,059-6,468	35.5	19-54.5	2,604	950-3,600	4.3	1.5-9	317	78-604
Type:												
25 dermal-----	55.6	37-67	4,442	2,600-5,781	37.5	24-50.5	3,009	2,025-4,747	3.6	1-7.5	200	82-735
25 neural-----	57.4	35.5-72	4,389	2,059-6,566	35.5	22-54.5	2,698	1,585-3,600	4.2	1-7.5	322	70-688
Skin involvement:												
25 extensive-----	54.7	32-74	4,135	5,200-9,200	36.8	16.5-58	2,792	1,320-5,108	4.5	1-12	342	92-984
25 slight-----	59	45.5-72	4,548	5,200-9,800	29.8	21-51	2,257	1,584-4,656	3.8	1-9	290	70-604
Activity:												
25 active-----	54.4	35.5-67	4,180	2,059-5,781	38.7	28-54.5	3,087	2,054-4,747	3.7	1-7.5	295	82-708
25 quiescent-----	57.5	40-71.5	4,497	2,600-6,566	35.4	19-50	2,699	950-3,738	4.5	2-9	342	132-608
Chaulmoogra therapy:												
25 E. E. C-----	57.9	38-71.5	4,670	3,208-6,468	35.1	19-49.5	2,751	950-4,356	4	1-9.5	309	78-780
25 Do E. E. C-----	58.3	32-74	4,520	2,059-6,468	35.3	16.5-54.5	2,776	1,320-4,656	4.7	1-12	380	82-984

The blood picture of these cases of leprosy is remarkably similar to the blood pictures obtained by various observers on groups of normal adults. This similarity is shown in Table 11.

TABLE 11.—*A comparison of the blood pictures in 75 cases of leprosy and in normal adults*

Observer	Number examined	Average per cent of—				
		Neutrophils	Lymphocytes	Mono-cytes	Eosino-philic	Baso-philic
Author <sup>1</sup>	75 lepers	56.1	35.9	4.3	2.8	0.3
Fisher and Tsung (1)	75 Chinese	53.5	35.3	6.1	4.6	.4
Wallace (5)	40 whites	54.6	38.8	3.7	1.1	1.8
Fairley (6)	29 whites	54.5	39.1	4.5	1.5	.4
Stains, et al. (10)	100 whites	54.5	36.0	7.0	2.5	0
Shaw (12)	116 whites	53.2	36.8	6.7	2.5	.7
Chamberlain et al. (2)	50 Filipinos	52.2	29.9	4.6	10.6	.7
Do	72 whites	56.8	31.7	6.9	3.8	.8
Mehrtens (4)	100 whites	56.5	37.5	4.5	0.97	.52

<sup>1</sup> Present study.

**Conclusions.**—From the study of this group of 75 cases of leprosy, the following conclusions may be drawn: (1) The total number of leucocytes is normal; (2) the number of the various types of cells falls within the variations found in normal individuals; (3) there is no relation between the blood picture and the bacteriological findings, the type of the disease, the degree of skin involvement, the degree of clinical activity, and the administration of the ethyl esters of chaulmoogra oil.

#### GROUP 2. ONE HUNDRED AND TWENTY-SIX PATIENTS, SOME DURING LEPROUS REACTIONS

##### THE RELATION OF THE WHITE BLOOD CELL PICTURE TO CLINICAL PROGRESS

The blood counts were studied in relation to acute, subacute, and chronic leprosy reactions; to steady and definite improvement; and to the state of apparent quiescence or arrest. While a truer conception of the blood picture is gained when the absolute numbers of the various types of cells are determined, the relative counts alone are satisfactory for the study of their relation to clinical changes. All specimens of blood were obtained between 10 a. m. and 11 a. m.

**Acute leprosy reaction.**—The term "acute leprosy reaction" used in this report is applied to that phase of the disease characterized by a temperature of 101° F., or over, accompanied by acute dermal or neural, or both dermal and neural, manifestations.

At the onset of an acute leprosy reaction there occurs a relative neutrophilic leucocytosis, as in many acute infections. The lymphocytes are decreased and the monocytes are normal in number. The average numbers of these cells at the height of 10 acute reactions

were as follows: Neutrophiles, 80 per cent; lymphocytes, 15.8 per cent; and monocytes, 3.6 per cent.

As convalescence begins, or shortly before, the number of neutrophiles decreases and the number of lymphocytes increases; and as convalescence continues, this change in the proportion of these cells continues, and the lymphocytes, often reaching a higher number than before the reaction, may exceed the neutrophiles in number. At some time during convalescence there apparently occurs a temporary increase in the number of monocytes, the number again decreasing as convalescence continues.

TABLE 12.—*The relative number of neutrophiles, lymphocytes, and monocytes during acute leprous reactions*

Case	Type of cell	Stage of reaction					
		Before	At onset	At height	During convalescence		
2712-----	Neutrophiles-----	52.5	72	84	67	53	36
	Lymphocytes-----	35	17.5	10-14	22	38	54
	Monocytes-----	3	10	1.5-5	10	7	5
2378-----	Neutrophiles-----		77	82.5	60	55	45
	Lymphocytes-----		5	12	32.5	35	39.5
	Monocytes-----		18	5	5	6	13.5
2749-----	Neutrophiles-----	52		76	50	48	-----
	Lymphocytes-----	42		18	39.5	48	-----
	Monocytes-----	2.5		5.5	5.5	3	-----
2750-----	Neutrophiles-----			79	64.5	49.5	-----
	Lymphocytes-----			20.5	30.5	40.5	-----
	Monocytes-----			0.5	4	8.5	-----
2809-----	Neutrophiles-----			74	38	40	-----
	Lymphocytes-----			21	42.5	48	-----
	Monocytes-----			4	13	5	-----
2004-----	Neutrophiles-----			88	66	58	50
	Lymphocytes-----			9	26.5	37.5	43
	Monocytes-----			3	6	4.5	3
2808-----	Neutrophiles-----				47	45.5	26
	Lymphocytes-----				38.5	39.5	67.5
	Monocytes-----				6.5	8.5	4.5

The changes in the leucocyte picture occurring during acute reactions are tabulated in Table 12. Three of these cases are here described in detail:

*Case 2712.*—M. C. (Table 12, Chart 1). Previous to the onset of the reaction the leprous manifestation showed slight improvement, at which time the blood cell count was: Neutrophiles, 52.5 per cent; lymphocytes, 35 per cent, and the monocytes, 3 per cent. The onset of the reaction was sudden and characterized by edema of the hands and feet, the appearance of new erythematous nodular lesions over ears, face, and extremities, and a temperature of 101.6° F. The temperature reached the highest point of 105° F. on the fifth day. By the fourth day of the reaction the neutrophiles had increased to 72 per cent, the lymphocytes had decreased to 17.5 per cent, and the monocytes had increased to 10 per cent. As the reaction continued, the neutrophiles continued to increase until they reached 84.5 per cent, and the lymphocytes decreased to 10 per cent. As convalescence set in and continued the neutrophiles gradually decreased to 36 per cent and the lymphocytes increased to 54 per cent. During the first few days of the reaction the number of monocytes fluctuated and then remained for a period of two weeks between 1.5 and 5.5 per cent.

As convalescence began the number increased to 10.5 per cent and then decreased as convalescence continued.

Case 2094.—M. K. (Table 12, Chart 2). Following a normal parturition there developed an acute leprous reaction characterized by the appearance of

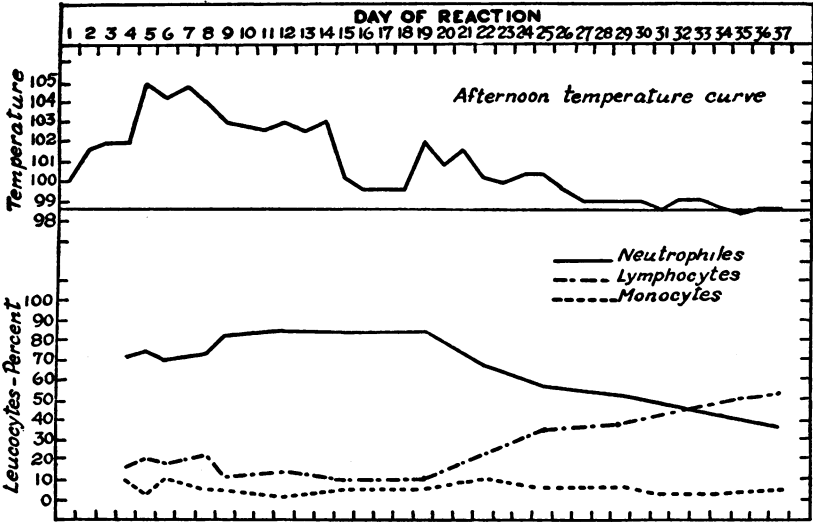


CHART 1.—(Case 2712) Changes in the relative number of neutrophils, lymphocytes, and monocytes during an acute leprous reaction

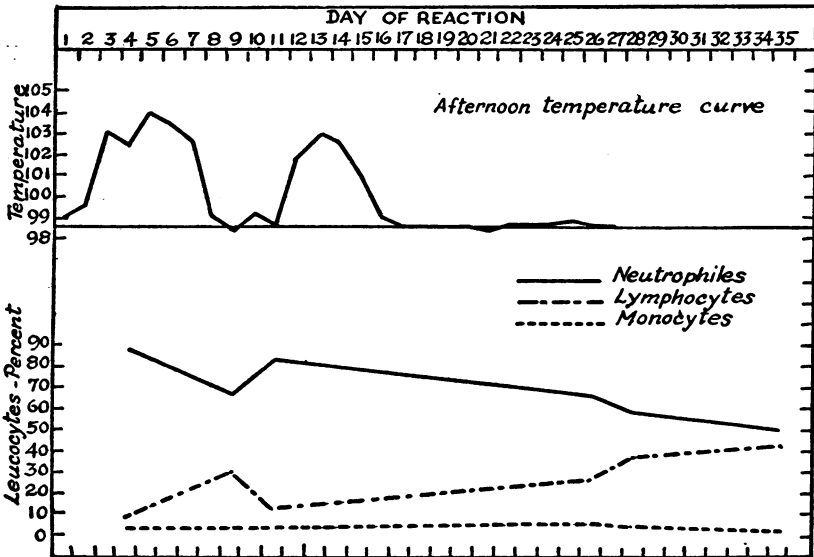


CHART 2.—(Case 2094) Changes in the relative number of neutrophils, lymphocytes, and monocytes during an acute leprous reaction

new erythematous urticarial type of lesions over the extremities. The temperature on the third day reached 103° F., at which time the neutrophils numbered 88, the lymphocytes 9, and the monocytes 3 per cent. On the fifth day the lesions began to retrogress and the fever to subside. On the eighth

day a new crop of lesions appeared, accompanied by a second febrile period with a blood count showing 82.5 per cent neutrophils, 13 per cent lymphocytes, and 3.5 per cent monocytes. During the interval between the febrile periods the neutrophils had decreased to 66.5 per cent and the lymphocytes had increased

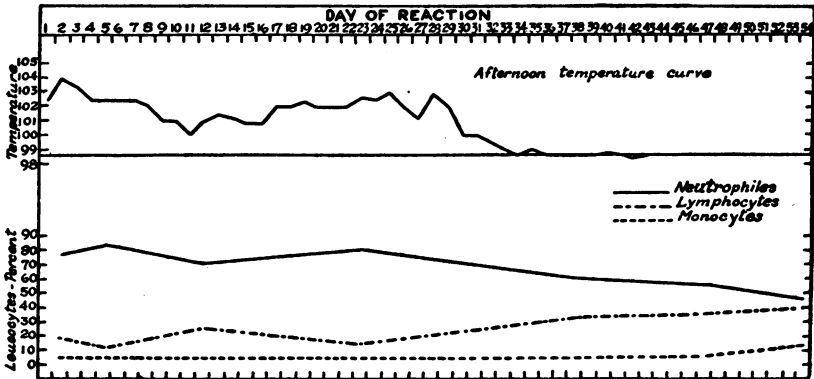


CHART 3.—(Case 2378) Changes in the relative number of neutrophils, lymphocytes, and monocytes during an acute leprous reaction

to 30 per cent. On the twelfth day convalescence began and continued to recovery from the reaction.

Case 2898.—C. E. (Table 12). While on temporary release from segregation the disease reactivated, the reactivation occurring as an acute leprous reaction.

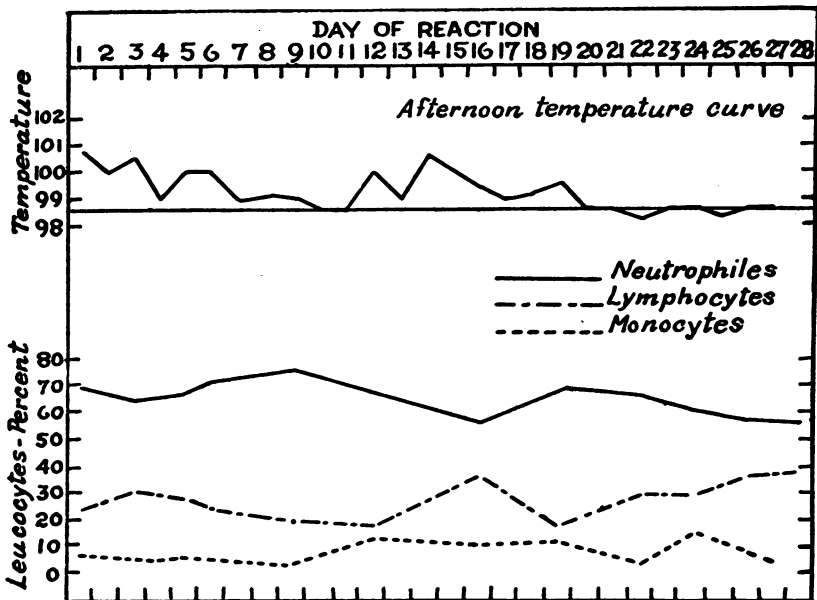


CHART 4.—(Case 2875) Changes in the relative number of neutrophils, lymphocytes, and monocytes during a subacute leprous reaction

The patient was readmitted to the hospital during convalescence from the reaction, and the changes in the number of cells were similar to the others during convalescence from acute reaction.

**Subacute reactions.**—A subacute reaction is a change in the clinical progress of the disease characterized by the appearance of new, or the reactivation of existing, lesions accompanied by a moderate rise in temperature. The blood changes during this type of reaction are similar to, though less marked than, those occurring during an acute reaction. The average percentage of the blood cells during the height of six subacute reactions were: Neutrophiles, 70.8 per cent; lymphocytes, 24.7 per cent; and the monocytes, 3.3 per cent. This type of reaction is illustrated by the following case:

*Case E. H.* (Chart 4).—For three months there had occurred a slow progression in the disease characterized by an increase in nodulation, edema, and

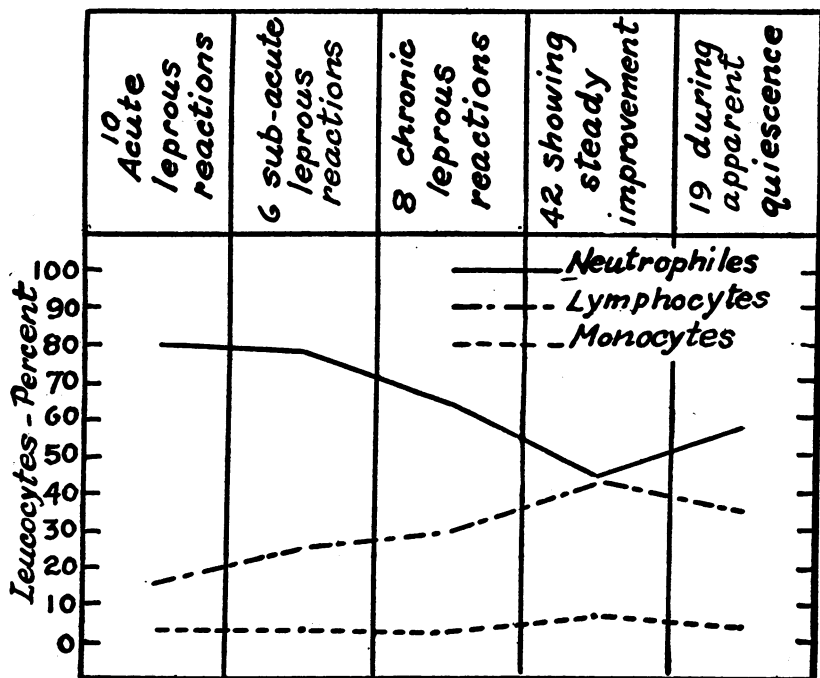


CHART 5.—A comparison of the average percentages of neutrophiles, lymphocytes, and monocytes in the various stages of clinical activity

cyanosis. Following this period there occurred a generalized eruption accompanied by a febrile period of three weeks. Following the acute period there did not occur marked clinical improvement, the condition going on into the slow retrogression that took place previous to the reaction. As shown in Chart 4, the marked changes in the blood picture noted in the acute reactions were not seen.

**Chronic reactions.**—A chronic reaction is that type of clinical retrogression characterized by the frequent appearance of new lesions, accompanied by no, or but slight, elevation of temperature, and as a rule continuing over a period varying from a few weeks to months. This type of reaction is more common in those cases with definitely nodular lesions and may consist of the continued appear-



ance of new lesions or the development of frequent crops of lesions. The blood in eight such reactions has been studied and showed counts similar to those in the subacute reactions, the averages being: Neutrophiles, 65 per cent; lymphocytes, 29.2 per cent; and monocytes, 2.6 per cent.

*Slow and definite improvement.*—A large per cent of lepers in segregation, under changed environment and improved hygiene, show, for a time at least, a slow, steady improvement. At Kalihi Hospital it has been noted that most of the patients, regardless of the method of therapy, show a definite improvement during the first three or four months in segregation and many, following this preliminary period, continue to improve. It is in this type of case that the changes in the number of the white blood cells, relative to the clinical progress, are the most evident. The changes take place much more slowly than during the reactions and, therefore, by frequent examination, are generally detected. The average found in 61 examinations made on the blood of 42 patients during definite clinical improvement were: Neutrophiles, 45.6 per cent; lymphocytes, 43.7 per cent; and monocytes, 7 per cent. The changes noted in this type of case are tabulated in Table 13.

TABLE 13.—Percentages of neutrophiles, lymphocytes, and monocytes during slow and definite improvement

Case	Date	Neutrophiles	Lymphocytes	Monocytes
2879	Jan. 14, 1929	59.5	33.5	1.5
	May 8, 1929	36.5	52.5	7
	Aug. 9, 1929	30	57	9
2839	Oct. 24, 1928	52	39.5	4.5
	Apr. 29, 1929	29.5	49.5	16.5
	July 17, 1929	44	40	6
2888	Feb. 11, 1929	62.5	34.5	1
	Apr. 29, 1929	44	46	8.5
	Aug. 9, 1929	43.5	49.5	4.5
2891	Feb. 11, 1929	48.5	40	3.5
	Apr. 29, 1929	27	60	12
	Aug. 9, 1929	28.5	66	5.5
2874	Oct. 24, 1928	69.5	18.5	2.5
	June 17, 1929	57	35	4
	Aug. 9, 1929	43	43.5	7
2887	Feb. 13, 1929	56	41.5	1.5
	June 14, 1929	47	42.5	8.5
	Aug. 9, 1929	35	54.5	9
2856	Dec. 13, 1928	62.5	31.5	5
	Apr. 5, 1929	56.5	34.5	7.5
	June 14, 1929	45	43.5	10.5
2857	Apr. 1, 1929	47.5	45.5	4
	July 15, 1929	36.5	57	6
2858	Oct. 18, 1928	54	32	6
	Mar. 18, 1929	43	51	3
	May 8, 1929	53	52	13
2871	Aug. 9, 1929	24	66.5	8.5
	Feb. 21, 1929	59	37.5	2.5
	May 15, 1929	56	37	5.5
2866	Aug. 9, 1929	52	34.5	7
	Feb. 15, 1928	58	37.5	2
	Apr. 29, 1929	45	45	4.5
	May 6, 1929	42	42	9
	July 2, 1929	59	32	5

*Clinical quiescence.*—Differential white cell counts were made on the blood of 19 patients whose leprosy had become quiescent in so far as could be determined by clinical observation. The averages found in these cases were: Neutrophiles, 57.9 per cent; lymphocytes, 35.6 per cent, and monocytes, 4 per cent.

The white blood cells during five clinical stages of leprosy have been studied and a comparison of the results as shown in Table 14 and chart 5 has proved of interest. It will be noted that the curve is not unlike those illustrating the changes occurring during the reactions.

TABLE 14.—*A comparison of the average percentages of neutrophiles, lymphocytes, and monocytes in the various stages of activity*

Stage	Number of cases	Neutrophiles	Lymphocytes	Monocytes
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Acute reactions.....	10	80	15.8	3.6
Subacute reactions.....	6	70.8	24.7	3.3
Chronic reactions.....	8	65	29.5	2.6
Slow definite improvement.....	42	45.6	43.7	7
Quiescence.....	19	57.9	35.6	4

Although in the majority of instances there occurred apparent agreement between the blood picture and the clinical progress, there were a few in which a disagreement was evident. In some, the blood counts were similar to those found in chronic or subacute reactions while clinically the leprosy progress was stationary or improving. In most of these instances the blood findings were later confirmed by clinical developments.

*Case 2533.*—E. A. At the time of the first blood examination the clinical condition was that of improvement, which was also suggested by the blood count. At the end of a five-month period, during which time the apparent improvement continued, the blood picture was that of a subacute or chronic reaction. One week later the blood findings were confirmed by the appearance of a subacute reaction.

*Case 2848.*—U. B. At the time of examination the clinical condition was that of quiescence and bacteriologically negative, but the blood picture was that of retrogression. Three weeks later reactivation of the previous lesions occurred and lepra bacilli were demonstrated.

*Case 2600.*—I. N. For several months previous to the examination of the blood there had occurred definite clinical improvement; however, a blood count suggested retrogression. Three weeks after the examination of the blood clinical reactivation occurred.

*Case 2741.*—F. K. For several months previous to the examination of the blood the clinical progress had been classed as stationary to slight improvement. The blood count was: Neutrophiles, 66.5 per cent; lymphocytes, 26 per cent; and monocytes, 2 per cent, and suggested a chronic or subacute reaction. A short time after the examination new lesions appeared.

In these cases just discussed the blood counts predicted reactivation and reactions.

**Case 2819.**—T. H. At the time of the first examination of the blood the disease was apparently clinically quiescent, though bacteriologically positive in the nasal membrane, while the blood count of: Neutrophiles, 67 per cent; lymphocytes, 25 per cent; and monocytes, 6 per cent, suggested a reactionary phase. Three months later, when still clinically quiescent and after becoming bacteriologically negative, the blood count had changed to: Neutrophiles, 37.5 per cent; lymphocytes, 43.5 per cent; and monocytes, 8 per cent—counts agreeing with the clinical findings.

It is believed that in the five cases just discussed the blood counts gave a truer index as to the progress of the disease than did the clinical observations.

This study suggests that during the acute and active stages of leprosy there occurs a normal or increased number of neutrophiles, with a normal or decreased number of lymphocytes. As improvement begins, the neutrophiles decrease and the lymphocytes increase; and as improvement continues and goes to quiescence, the number of these two types of white blood cells approach normal. The monocytes, though the relation is less definite, alter in number with clinical changes.

Flin (30), from a study of the differential blood counts in active tuberculosis, found that the monocyte-lymphocyte and the lymphocyte-neutrophile ratios gave him a definite conception of the status and progress of his cases. It was believed, since there appears to be a definite relation between the neutrophile, lymphocyte, and monocyte numbers to the clinical progress of leprosy, that similar ratios might serve as an index of the progress of the disease. A number of cases, whose progress was felt to be fairly definitely known, were selected and studied to determine the possibility of such a relation. The group included cases during acute, subacute, and chronic reactions, definite clinical improvement, a state of clinical quiescence, and the state of apparent arrest. From such a study the following indications were determined.

A. Stationary to retrogression was indicated when—

1. The neutrophile-lymphocyte ratio was 2:1 or over, and the lymphocyte-monocyte ratio was 10:1 or under, or when
2. The neutrophile-lymphocyte ratio was 1:1 or over, and the lymphocyte-monocyte ratio was 10:1 or over.

B. Stationary to improvement was indicated when—

1. The neutrophile-lymphocyte ratio was 1:1 or under, and the lymphocyte-monocyte ratio was 10:1 or over, or when
2. The neutrophile-lymphocyte ratio was 2:1 or under, and the lymphocyte-monocyte ratio was 10:1 or under.

After determining this basis for comparison between the ratio index and the clinical progress, 264 determinations were made with the blood of 126 patients. Eighty-five and two-tenths per cent agreed with the clinical observations, 12.5 per cent disagreed, and

2.2 per cent were indefinite or border line. Later developments, either clinically or by blood cell changes, in those disagreeing, showed the ratios to be more significant as to the progress of the disease than did the clinical examinations.

#### PRACTICAL APPLICATIONS

This study suggests that the frequent examination of the blood has a practical value in the treatment of lepers:

(1) The examination of the white blood cells of a patient at the time of admission to a leprosarium for treatment will give an index as to the stage in the progress of the disease at that time.

It is hypothesized from clinical observations and histories obtained on the patients at Kalihi Hospital that leprosy runs a course marked by periods of activity and periods of quiescence. The periods of activity may vary in severity, frequency, and duration. Following a single period of activity the disease may go on to quiescence and arrest. Other cases may have a series of periods of acute activity with intervals of quiescence of varying length. Still others may show chronic activity over long periods of time.

A case of leprosy may be admitted for treatment at any time during the course of the disease. He may be admitted during the height, just previous to, or following a period of activity, or he may be admitted during a period of prolonged chronic activity. Occasionally a case is first detected during a quiescent period or arrest.

The examination of the blood in many instances will probably aid more in the determination of the stage of the disease on admission than will clinical observations alone. The blood of 23 individuals was examined at the time of admission to the hospital. Of these, 8 (or 34.7 per cent), as suggested by the blood counts, were in the stage of improvement when admitted. They have continued to improve since admission. The continued improvement has been shown by clinical observations as well as changes in the blood picture.

(2) A knowledge of the blood may aid in determining the value of any therapeutic agent or method of treatment. If, as suggested by this study, the blood examination gives an index as to the true progress of a disease, examination of the blood will, in many instances, show improvement in the progress of the disease, before a definite form of treatment is instituted. Too often is a therapeutic agent held responsible for clinical improvement in leprosy in cases which would have improved regardless of the treatment. If a blood examination will reveal that improvement in the progress of the disease is occurring before instituting a form of treatment, it will aid in determining the true value of a therapeutic agent.

(3) A blood examination may aid in predicting reactions or re-activations. In several instances, while this study was in progress,

the blood picture suggested a reactionary state while the clinical findings suggested continued improvement or quiescence. In many of these the blood findings were confirmed by clinical reactivation occurring shortly after the blood was examined. This may prove of special value in predicting reactivation in cases on temporary release (parole) from segregation.

(4) Repeated blood examinations may aid in the determination of fitness for release from segregation. If the blood picture gives an index of the stage in progress of the disease, the blood examination should, in conjunction with the clinical observations and bacteriological examinations, aid in determining fitness of a patient for parole.

#### SUMMARY

1. The white blood cell pictures of 75 uncomplicated cases of leprosy, not suffering with acute or subacute leprous reactions, were studied. The total leucocyte counts and the numbers of the different types of white cells were found to be within normal limits.

2. These cases were studied from the aspects of bacteriology, type of leprosy, degree of skin involvements, stage of activity, and chaulmoogra oil therapy. No apparent relation between these factors and the white blood cell picture was noted.

3. The blood pictures of 126 patients were studied in relation to the clinical progress of the disease. There were noted definite changes in the white blood cell picture correlating clinical changes. This study suggests that frequent examinations of the blood are of practical value in the treatment of leprosy; in determining the value of a therapeutic agent; in predicting leprous reactions and reactivation; and in determining the fitness of a patient for parole. The blood examinations, in addition to the bacteriological and clinical examinations, aid in the determination of the true progress of a patient.

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## COURT DECISION RELATING TO PUBLIC HEALTH

*Filled milk law held void.*—(Illinois Supreme Court: *People v. Carolene Products Co.*, 177 N. E. 698; decided June 18, 1931.) An Illinois statute provided as follows:

SEC. 19½. No person shall manufacture, sell, or exchange, or have in possession with intent to sell or exchange, any milk, cream, skim milk, buttermilk, condensed or evaporated milk, powdered milk, condensed skim milk, or any of the fluid derivatives of any of them to which has been added any fat or oil other than milk fat, either under the name of said products or articles or the derivatives thereof or under any fictitious or trade name whatsoever.

The defendant company was charged with violating this statute, and an action in debt was brought by the State for the recovery of a penalty. The cause was submitted to the trial court upon an agreed statement of facts. This statement showed that the defendant manufactured and possessed a product called "Carolene"; that Carolene was composed of evaporated skimmed milk to which was added coconut oil, which oil was a fat other than milk fat; that neither the evaporated skimmed milk, the coconut oil, or the combination was harmful or deleterious to health in any way; that the product was manufactured in a sanitary manner and its possession was in no way dangerous to the public; that it had the general appearance of ordinary evaporated milk and was packed in 1-pound, air-tight tin cans bearing certain statements; that the use of coconut oil in oleomargarine was not prohibited by the laws of the State; and that Carolene was not intended to be sold by defendant to customers in the State. No question of imitation or fraud was involved and the wholesomeness of the product was admitted.

The trial court held the statute to be unconstitutional and the State appealed. The judgment of the trial court was affirmed by the supreme court, and the following are excerpts from the latter court's opinion:

The legislature has no authority to pronounce the performance of an innocent act criminal when the public health, safety, comfort, or welfare is not interfered with [case cited], and may not, under the guise of protecting the public interests, arbitrarily interfere with private business or impose unusual and unnecessary restrictions upon lawful occupations [case cited]. \* \* \*

This court has by many decisions upheld the right of the citizen to engage in any occupation not detrimental to the public health, safety, and welfare, free from regulation by the exercise of the police power. [Cases cited.] The measures adopted by the legislature to protect the public health and secure the public safety and welfare must have some relation to these proposed ends. [Case cited.] Rights of property will not be permitted to be invaded under the guise of police regulation. [Case cited.] If it is manifest that the statute or ordinance, under the guise of a police regulation, does not tend to preserve the public health, safety, or welfare, it is void as an invasion of the property rights of the individual. [Cases cited.]

\* \* \* \* \*

Under the facts admitted in this case, the legislature has exceeded its constitutional power in enacting the law in question. It is admitted that Carotene is not poisonous or explosive and that it does not injuriously affect the health, safety, or welfare of the people. Coconut oil is admitted to be a healthful substance and is the principal ingredient of oleomargarine. It is unreasonable to permit coconut oil to be freely used as the principal ingredient of oleomargarine by one manufacturer and prohibit its use in smaller proportions by another manufacturer of a food product admitted to be equally wholesome and healthful. No showing is made that such a restriction is justified to protect the public health or to prevent fraud. Section 19½ is arbitrary and unreasonable and is, therefore, a void enactment.

## DEATHS DURING WEEK ENDED OCTOBER 31, 1931

*Summary of information received by telegraph from industrial insurance companies for the week ended October 31, 1931, and corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)*

	Week ended Oct. 31, 1931	Corresponding week, 1930
Policies in force.....	74, 425, 301	75, 382, 865
Number of death claims.....	11, 828	13, 628
Death claims per 1,000 policies in force, annual rate.....	8.3	9.4
Death claims per 1,000 policies, first 44 weeks of year, annual rate.....	9.7	9.6

*Deaths<sup>1</sup> from all causes in certain large cities of the United States during the week ended October 31, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)*

[The rates published in this summary are based upon midyear population estimates derived from the 1930 census]

City	Week ended Oct. 31, 1931				Corresponding week, 1930		Death rate <sup>1</sup> for the first 44 weeks	
	Total deaths	Death rate <sup>1</sup>	Deaths under 1 year	Infant mortality rate <sup>1</sup>	Death rate <sup>1</sup>	Deaths under 1 year	1931	1930
Total (82 cities).....	7,453	10.9	605	4.47	11.6	721	11.9	11.9
Akron.....	41	8.3	6	59	8.0	5	7.8	7.9
Albany.....	38	15.3	2	40	16.3	2	13.9	14.7
Atlanta.....	66	12.4	7	72	13.2	7	15.0	15.6
White.....	35	9.9	2	32	10.7	3	11.6	11.6
Colored.....	31	17.3	5	144	18.4	4	21.6	23.7
Baltimore.....	205	13.1	27	91	15.6	32	14.3	13.9
White.....	151	11.8	17	74	13.9	22	13.0	12.7
Colored.....	54	19.2	10	156	23.6	10	20.1	19.9
Birmingham.....	42	8.1	6	60	14.0	8	13.3	13.6
White.....	16	5.0	4	69	11.6	5	10.2	10.3
Colored.....	26	13.2	2	49	17.8	3	18.3	19.0
Boston.....	216	14.3	31	89	12.9	21	14.2	14.1
Bridgeport.....	25	8.9	3	50	8.2	1	11.0	10.9
Buffalo.....	126	11.3	13	53	13.8	17	13.0	13.0
Cambridge.....	21	9.6	2	40	9.6	2	12.1	11.9
Camden.....	33	14.5	4	70	17.1	5	14.1	13.5
Canton.....	21	10.3	1	23	6.9	1	10.0	10.0
Chicago.....	620	9.3	41	36	10.3	51	10.6	10.4
Cincinnati.....	123	14.0	17	102	15.4	11	15.9	15.5
Cleveland.....	156	8.9	12	35	10.6	17	11.2	11.1
Columbus.....	78	13.8	10	98	14.8	6	13.5	15.5
Dallas.....	59	11.3	7	-----	13.7	8	11.1	11.4
White.....	36	8.3	4	-----	14.6	7	9.7	10.4
Colored.....	23	25.3	3	-----	9.2	1	17.7	16.0
Dayton.....	49	12.4	8	112	9.5	1	11.9	10.7
Denver.....	73	13.0	3	29	15.5	2	13.9	14.8
Des Moines.....	29	10.5	2	35	11.7	4	11.1	11.7
Detroit.....	243	7.7	29	46	8.6	38	8.2	9.3
Duluth.....	17	8.7	2	49	16.4	2	11.1	11.4
El Paso.....	22	10.9	4	-----	15.7	5	15.4	17.2
Erie.....	22	9.7	1	19	10.8	3	10.4	11.2
Fall River.....	17	7.7	2	45	10.0	0	11.1	11.8
Flint.....	13	4.1	8	102	9.6	4	6.9	9.2
Fort Worth.....	28	8.7	1	-----	7.6	0	10.7	10.9
White.....	24	8.9	1	-----	7.6	0	10.3	10.3
Colored.....	4	7.7	0	-----	7.9	0	12.9	13.8
Grand Rapids.....	26	7.9	2	30	9.2	1	9.1	10.2
Houston.....	59	9.9	11	-----	11.7	11	11.0	12.1
White.....	40	9.2	8	-----	10.3	8	10.2	10.7
Colored.....	19	11.9	3	-----	15.3	3	13.3	15.8
Indianapolis.....	89	12.5	12	99	13.7	9	13.8	14.6
White.....	75	12.0	10	94	12.5	6	13.4	13.6
Colored.....	14	16.2	2	134	22.4	3	17.0	21.9
Jersey City.....	69	11.3	6	53	10.4	5	11.4	11.3
Kansas City, Kans.....	29	12.3	1	21	9.8	1	12.6	11.7
White.....	21	11.0	1	25	8.4	1	11.9	11.0
Colored.....	8	17.8	0	0	15.9	0	15.5	14.9
Kansas City, Mo.....	80	10.2	5	38	13.9	7	13.0	13.3
Knoxville.....	18	8.6	0	0	8.3	3	12.2	13.5
White.....	13	7.4	0	0	7.6	3	11.4	12.7
Colored.....	5	14.6	0	0	12.1	0	16.6	17.8
Long Beach.....	36	12.3	0	0	7.6	3	9.8	9.9
Los Angeles.....	230	9.1	15	44	11.2	17	10.6	11.0
Louisville.....	68	11.5	7	60	11.2	6	14.1	13.6
White.....	47	9.4	4	39	11.2	6	12.6	12.1
Colored.....	21	23.0	3	199	11.0	0	22.0	21.4
Lowell.....	25	12.9	1	25	10.9	1	12.8	13.4
Lynn.....	18	9.1	1	26	9.2	2	9.4	10.4
Memphis.....	81	16.3	6	63	17.0	11	16.6	17.0
White.....	45	14.7	4	67	13.3	4	13.6	13.2
Colored.....	36	19.0	2	58	23.1	7	21.5	23.2
Miami.....	19	8.8	1	25	5.6	2	11.7	10.9
White.....	15	9.0	1	35	4.9	2	10.8	9.6
Colored.....	4	8.2	0	0	8.3	0	14.9	15.4

See footnotes at end of table.



*Deaths<sup>1</sup> from all causes in certain large cities of the United States during the week ended October 31, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)—Continued*

City	Week ended Oct. 31, 1931				Corresponding week, 1930		Death rate <sup>2</sup> for the first 44 weeks	
	Total deaths	Death rate <sup>2</sup>	Deaths under 1 year	Infant mortality rate <sup>3</sup>	Death rate <sup>2</sup>	Deaths under 1 year	1931	1930
Milwaukee.....	73	6.5	11	48	8.5	8	9.2	9.6
Minneapolis.....	97	10.7	10	64	12.0	17	11.2	10.7
Nashville <sup>4</sup> .....	52	17.4	8	119	15.6	7	16.8	16.5
White.....	36	16.7	6	120	14.1	4	14.3	13.9
Colored.....	16	19.5	2	118	19.4	3	23.5	23.4
New Bedford <sup>5</sup> .....	28	13.0	2	53	13.0	1	12.1	11.0
New Haven.....	54	17.3	1	19	15.1	1	12.5	12.7
New Orleans <sup>6</sup> .....	122	13.6	12	66	17.2	19	16.7	17.4
White.....	64	10.0	9	74	13.8	12	13.6	14.3
Colored.....	58	22.5	3	49	25.7	7	24.5	25.0
New York.....	1,415	10.4	95	40	10.7	122	11.1	10.8
Bronx Borough.....	201	7.9	8	18	8.6	18	8.2	7.9
Brooklyn Borough.....	476	9.4	45	48	9.3	47	10.2	9.8
Manhattan Borough.....	555	16.2	28	48	16.6	47	16.8	16.0
Queens Borough.....	141	6.4	11	30	6.2	10	7.2	7.0
Richmond Borough.....	32	10.2	3	54	10.5	0	12.6	14.2
Newark, N. J.....	92	10.8	9	47	10.8	5	11.6	12.0
Oakland.....	54	9.6	2	26	12.6	7	10.5	11.0
Oklahoma City.....	30	7.9	3	41	7.2	2	10.7	10.7
Omaha.....	52	12.5	4	45	12.9	5	13.8	13.5
Paterson.....	50	18.8	0	0	14.3	3	13.3	12.2
Peoria.....	20	9.6	1	26	11.8	3	12.6	12.2
Philadelphia.....	430	11.4	26	38	12.9	52	13.0	12.6
Pittsburgh.....	200	15.4	13	45	14.0	18	14.4	13.8
Portland, Oreg.....	67	11.4	2	24	11.2	0	11.6	12.1
Providence.....	52	10.6	0	0	10.5	4	12.7	12.8
Richmond <sup>6</sup> .....	45	12.7	5	73	17.1	10	15.5	14.8
White.....	23	9.1	2	44	11.2	2	13.0	12.1
Colored.....	22	21.7	3	130	31.5	8	21.6	21.5
Rochester.....	67	10.5	5	46	11.1	2	11.9	11.5
St. Louis.....	190	12.0	11	37	13.6	13	15.0	14.1
St. Paul.....	45	8.5	6	62	8.8	2	10.6	10.1
Salt Lake City <sup>4</sup> .....	20	7.3	2	30	15.2	7	12.1	12.3
San Antonio.....	49	10.6	3	-----	10.5	6	14.3	16.2
San Diego.....	36	12.0	1	20	12.2	2	13.4	14.3
San Francisco.....	183	14.7	5	33	9.1	2	13.1	12.9
Schenectady.....	25	13.6	1	29	11.4	2	10.6	11.2
Seattle.....	82	11.5	2	19	11.9	9	11.3	10.8
Somerville.....	15	7.4	0	0	6.5	1	8.8	9.7
South Bend.....	14	6.8	1	25	10.4	1	8.0	8.9
Spokane.....	29	13.0	0	0	15.3	3	12.3	12.5
Springfield, Mass.....	27	9.2	5	77	11.1	6	11.6	12.1
Syracuse.....	45	11.0	3	36	7.7	6	11.5	11.5
Tacoma.....	25	12.1	0	0	15.6	2	12.1	12.5
Toledo.....	58	10.2	6	55	12.3	10	11.9	12.7
Trenton.....	45	18.9	2	35	12.7	3	16.5	16.6
Utica.....	34	17.3	0	0	16.4	1	14.2	14.8
Washington, D. C. <sup>6</sup> .....	160	17.0	16	89	16.5	17	15.9	15.1
White.....	100	14.6	8	65	14.9	10	13.6	12.9
Colored.....	60	23.2	8	138	20.7	7	22.0	20.8
Waterbury.....	16	8.3	1	30	6.8	2	9.6	9.5
Wilmington, Del. <sup>7</sup> .....	26	12.7	2	43	12.7	5	13.9	14.4
Worcester.....	46	12.2	4	55	12.0	1	12.1	12.7
Yonkers.....	20	7.5	3	79	10.0	0	8.4	8.1
Youngstown.....	33	10.0	5	70	11.3	3	10.0	10.3

<sup>1</sup> Deaths of nonresidents are included. Stillbirths are excluded.

<sup>2</sup> These rates represent annual rates per 1,000 population, as estimated for 1931 and 1930 by the arithmetical method.

<sup>3</sup> Deaths under 1 year of age per 1,000 live births. Cities left blank are not in the registration area for births.

<sup>4</sup> Data for 77 cities.

<sup>5</sup> Deaths for week ended Friday.

<sup>6</sup> For the cities for which deaths are shown by color, the percentages of colored population in 1930 were as follows: Atlanta, 33; Baltimore, 18; Birmingham, 38; Dallas, 17; Fort Worth, 16; Houston, 27; Indianapolis, 12; Kansas City, Kans., 19; Knoxville, 16; Louisville, 15; Memphis, 38; Miami, 23; Nashville, 28; New Orleans, 29; Richmond, 29; and Washington, D. C., 27.

<sup>7</sup> Population Apr. 1, 1930; decreased 1920 to 1930, no estimate made.

# PREVALENCE OF DISEASE

*No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring*

## UNITED STATES

### CURRENT WEEKLY STATE REPORTS

[These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers]

**Reports for Weeks Ended November 7, 1931, and November 8, 1930**

*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended November 7, 1931, and November 8, 1930*

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930
<b>New England States:</b>								
Maine.....	5	1	2		171	66	0	1
New Hampshire.....	8	1			15		0	0
Vermont.....	12	5			66	3	0	0
Massachusetts.....	61	67	4	2	62	78	6	3
Rhode Island.....	11	10		1	105		0	0
Connecticut.....	5	6	4	7	12	55	0	3
<b>Middle Atlantic States:</b>								
New York.....	68	74	15	11	145	71	8	12
New Jersey.....	34	62	6	16	19	71	1	2
Pennsylvania.....	104	132			205	109	4	4
<b>East North Central States:</b>								
Ohio.....	164	65	13	1	50	25	1	3
Indiana.....	94	55	1	2	74	28	0	3
Illinois.....	172	180	8	6	30	46	3	3
Michigan.....	63	85		3	21	40	7	4
Wisconsin.....	30	13	14	26	14	41	3	2
<b>West North Central States:</b>								
Minnesota.....	14	14	3		8	6	3	1
Iowa.....	10	16			5	2	3	1
Missouri.....	94	47	14	2	7	137	3	3
North Dakota.....	3	11			2	7	0	6
South Dakota.....	4	8			2		1	0
Nebraska.....	18	13	8		12	5	0	1
Kansas.....	112	10	3		24	3	0	1
<b>South Atlantic States:</b>								
Delaware.....	33	5					0	0
Maryland <sup>1</sup> .....	47	31	10	17	3	6	1	1
District of Columbia.....	13	9		1	1	3	0	1
Virginia.....								
West Virginia.....	95	36	22	11	106	26	1	0
North Carolina.....	237	154	25	8	60	9	2	2
South Carolina.....	39	63	289	498	17		0	0
Georgia <sup>2</sup> .....	56	26	57	67	5	3	1	0
Florida.....	32	22	1		7	6	0	0

<sup>1</sup> New York City only.

<sup>2</sup> Week ended Friday.

<sup>3</sup> Typhus fever, 1931, 8 cases: 6 cases in Georgia and 2 cases in Alabama.

*Cases of certain communicable diseases reported by telegraph by State health officers  
for weeks ended November 7, 1931, and November 8, 1930—Continued*

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930
<b>East South Central States:</b>								
Kentucky.....	219						1	5
Tennessee.....	151	57	31	35		3	2	2
Alabama <sup>1</sup> .....	134	34	9	27	4	28	1	3
Mississippi.....	104	92					0	2
<b>West South Central States:</b>								
Arkansas.....	82	21	17	12		4	0	0
Louisiana.....	36	45	10	23	15	1	1	1
Oklahoma <sup>1</sup> .....	109	62	21	28	4	10	0	2
Texas.....	84	94	11	69	11	8	1	0
<b>Mountain States:</b>								
Montana.....	2	1			71		0	1
Idaho.....	2	1				3	0	2
Wyoming.....		2			1		0	0
Colorado.....	4	14			4	215	0	0
New Mexico.....	21	6				7	0	1
Arizona.....	12	13		2		39	0	1
Utah <sup>1</sup> .....		3	4	10		3	0	0
<b>Pacific States:</b>								
Washington.....	13	22	4		38	5	1	3
Oregon.....	3	3	43	10	5	40	0	0
California.....	106	85	41	29	168	109	2	3

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930
<b>New England States:</b>								
Maine.....	5	5	32	18	0	0	5	7
New Hampshire.....	0	1	7	8	0	0	0	1
Vermont.....	4	0	11	6	22	3	0	0
Massachusetts.....	19	13	195	153	0	0	4	5
Rhode Island.....	0	0	16	15	0	0	0	2
Connecticut.....	17	2	27	32	0	0	4	9
<b>Middle Atlantic States:</b>								
New York.....	74	20	336	281	19	0	28	26
New Jersey.....	15	2	113	119	0	0	4	80
Pennsylvania.....	17	5	318	345	0	0	61	50
<b>East North Central States:</b>								
Ohio.....	4	43	335	288	11	15	39	41
Indiana.....	3	4	113	146	9	41	3	12
Illinois.....	33	19	287	339	19	25	14	15
Michigan.....	22	10	160	171	2	15	11	19
Wisconsin.....	23	7	71	86	0	6	3	5
<b>West North Central States:</b>								
Minnesota.....	30	26	41	53	2	10	0	3
Iowa.....	10	4	42	53	49	5	4	8
Missouri.....	3	8	92	99	3	11	13	34
North Dakota.....	3	3	10	20	12	19	5	4
South Dakota.....	2	5	6	6	2	13	2	3
Nebraska.....	0	12	26	20	3	15	2	0
Kansas.....	1	13	70	41	2	11	0	9
<b>South Atlantic States:</b>								
Delaware.....	0	0	7	10	0	0	2	1
Maryland <sup>1</sup> .....	2	2	78	43	0	0	30	21
District of Columbia.....	0	0	22	20	0	0	5	3
Virginia.....	2							
West Virginia.....	1	4	98	50	0	0	32	40
North Carolina.....	6	3	195	178	2	0	22	11
South Carolina.....	1	0	17	25	1	3	10	26
Georgia <sup>1</sup> .....	0	0	43	38	0	0	16	23
Florida.....	0	0	4	7	0	0	4	1

<sup>1</sup> Week ended Friday.

<sup>2</sup> Typhus fever, 1931, 8 cases: 6 cases in Georgia and 2 cases in Alabama.

<sup>3</sup> Figures for 1931 are exclusive of Oklahoma City and Tulsa.

*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended November 7, 1931, and November 8, 1930—Continued*

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930	Week ended Nov. 7, 1931	Week ended Nov. 8, 1930
<b>East South Central States:</b>								
Kentucky.....	1	2	10	114	6	0	42	34
Tennessee.....	1	0	93	62	6	1	33	17
Alabama <sup>1</sup> .....	0	3	53	63	0	2	19	8
Mississippi.....	2	1	43	34	10	0	12	37
<b>West South Central States:</b>								
Arkansas.....	0	0	48	15	7	4	15	26
Louisiana.....	2	1	23	21	1	0	18	9
Oklahoma <sup>1</sup> .....	0	1	26	38	8	2	27	29
Texas.....	0	12	48	40	0	6	17	30
<b>Mountain States:</b>								
Montana.....	1	2	17	11	1	2	2	1
Idaho.....	0	0	4	10	0	0	1	3
Wyoming.....	0	0	5	4	0	0	0	0
Colorado.....	0	4	23	26	0	2	18	3
New Mexico.....	0	3	10	7	0	0	9	10
Arizona.....	0	0	9	5	1	0	5	3
Utah <sup>1</sup> .....	0	0	12	15	0	1	0	0
<b>Pacific States:</b>								
Washington.....	2	1	58	48	10	10	3	10
Oregon.....	0	1	16	17	5	6	4	2
California.....	3	49	123	107	7	0	5	18

<sup>1</sup> Week ended Friday.

<sup>1</sup> Typhus fever, 1931, 8 cases: 6 cases in Georgia and 2 cases in Alabama.

<sup>1</sup> Figures for 1931 are exclusive of Oklahoma City and Tulsa.

### SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week:

State	Menin- gococ- cus menin- gitis	Diph- theria	Influ- enza	Ma- laria	Mea- sles	Pel- lagra	Polio- mye- litis	Scarlet fever	Small- pox	Ty- phoid fever
<i>September, 1931</i>										
Arkansas.....	2	149	-----	196	12	106	3	66	4	133
Kansas.....	-----	46	3	-----	28	-----	0	99	4	38
Montana.....	-----	11	6	1	43	-----	20	33	3	28
<i>October, 1931</i>										
Arizona.....	2	26	26	3	3	-----	4	22	1	17
Connecticut.....	2	20	15	-----	31	-----	152	100	0	17
District of Columbia.....	2	63	1	-----	5	3	5	55	0	13
Georgia.....	1	232	66	311	18	44	0	127	-----	147
Massachusetts.....	8	196	32	2	173	3	234	682	0	35
Nebraska.....	-----	81	4	-----	5	-----	6	73	10	6
Tennessee.....	13	802	66	426	16	53	10	359	13	247
Vermont.....	-----	9	-----	-----	78	-----	25	21	20	2

*September, 1931*

	Cases
Actinomycosis:	
Kansas.....	1
Chicken pox:	
Arkansas.....	6
Kansas.....	35
Montana.....	31
Dysentery:	
Kansas.....	1
German measles:	
Kansas.....	4
Hookworm disease:	
Arkansas.....	1
Impetigo contagiosa:	
Kansas.....	18
Montana.....	1
Mumps:	
Arkansas.....	14
Kansas.....	57
Montana.....	1
Ophthalmia neonatorum:	
Arkansas.....	1
Paratyphoid fever:	
Arkansas.....	1
Kansas.....	3
Rocky Mountain spotted or tick fever:	
Kansas.....	1
Scabies:	
Kansas.....	11
Septic sore throat:	
Kansas.....	1
Tetanus:	
Kansas.....	2
Trachoma:	
Arkansas.....	2
Montana.....	24
Undulant fever:	
Kansas.....	3
Vincent's angina:	
Kansas.....	8
Whooping cough:	
Arkansas.....	14
Kansas.....	51
Montana.....	40

*October, 1931*

Actinomycosis:	
Massachusetts.....	1
Anthrax:	
Massachusetts.....	1
Chicken pox:	
Arizona.....	50
Connecticut.....	30
District of Columbia.....	6
Georgia.....	12
Massachusetts.....	208
Nebraska.....	71
Tennessee.....	15
Vermont.....	46
Conjunctivitis, infectious:	
Connecticut.....	1
Dysentery:	
Arizona.....	1
Connecticut (bacillary).....	5
Georgia.....	19

Dysentery—Continued.	Cases
Massachusetts.....	1
Tennessee.....	12
German measles:	
Connecticut.....	5
Massachusetts.....	36
Tennessee.....	1
Impetigo contagiosa:	
Tennessee.....	4
Lead poisoning:	
Massachusetts.....	5
Lethargic encephalitis:	
Arizona.....	1
Connecticut.....	1
Massachusetts.....	1
Mumps:	
Arizona.....	3
Connecticut.....	44
Georgia.....	9
Massachusetts.....	293
Nebraska.....	35
Tennessee.....	32
Vermont.....	25
Ophthalmia neonatorum:	
Massachusetts.....	52
Paratyphoid fever:	
Connecticut.....	4
Georgia.....	5
Massachusetts.....	1
Tennessee.....	5
Puerperal septicemia:	
Tennessee.....	2
Rabies in animals:	
Connecticut.....	3
Septic sore throat:	
Connecticut.....	8
Georgia.....	37
Massachusetts.....	17
Nebraska.....	4
Tennessee.....	15
Tetanus:	
Connecticut.....	2
Massachusetts.....	9
Trachoma:	
Arizona.....	25
Connecticut.....	1
Massachusetts.....	3
Tennessee.....	2
Trichinosis:	
Massachusetts.....	1
Typhus fever:	
Georgia.....	17
Undulant fever:	
Arizona.....	3
Nebraska.....	1
Vincent's angina:	
Tennessee.....	3
Whooping cough:	
Arizona.....	14
Connecticut.....	196
District of Columbia.....	52
Georgia.....	16
Massachusetts.....	323
Nebraska.....	38
Tennessee.....	189
Vermont.....	123

# Cases of Certain Communicable Diseases Reported for the Month of July, 1931, by State Health Officers

State	Chicken pox	Diph- theria	Measles	Mumps	Scarlet fever	Small- pox	Tuber- culosis	Typhoid and paraty- phoid fever	Whoop- ing cough
Maine.....	45	8	64	55	35	0	54	4	55
New Hampshire.....		2			12	0		2	
Vermont.....	34	1	111	43	35	43	21	0	74
Massachusetts.....	370	168	965	270	482	0	672	87	520
Rhode Island.....	7	30	378	56	47	0	60	1	43
Connecticut.....	87	37	410	75	65	0	146	11	323
New York.....	919	398	3,660	669	684	37	1,626	88	2,029
New Jersey.....	324	91	771	129	244	1	455	22	1,536
Pennsylvania.....	691	233	2,520	639	728	2	725	90	1,468
Ohio.....	288	74	1,080	427	295	104	631	81	
Indiana.....	42	45	274	14	116	159	229	23	337
Illinois.....	361	299	1,780	274	444	123	964	81	1,365
Michigan.....	343	93	541	222	462	39	484	19	1,370
Wisconsin.....	504	36	1,073	791	125	16	224	23	849
Minnesota.....	115	15	168		88	4	345	11	184
Iowa.....	46	10	38	30	66	110	35	7	114
Missouri.....	28	57	102	37	81	28	255	100	532
North Dakota.....	8	15	26	10	17	36	12	2	31
South Dakota.....	20	13	6	8	22	8	26	17	36
Nebraska.....	46	9	4	79	15	27	31	10	36
Kansas.....	33	30	60	149	54	68	99	42	146
Delaware.....			96	3			13		39
Maryland.....		36	306	57	72	1	306	63	433
District of Columbia.....	24	27	38		24	0	84	6	139
Virginia.....	71	46	234		71	12	170	251	489
West Virginia.....	29	13	235		29	7	49	73	252
North Carolina.....	42	60	513		83	1		233	734
South Carolina.....	56	41	172	53	8	1	126	353	210
Georgia.....	21	15	68	39	42		154	252	49
Florida.....	5	27	65	9	12	0	64	39	42
Kentucky <sup>1</sup> .....									
Tennessee.....	17	12	158	18	43	27	160	199	215
Alabama.....	12	34	113	21	39	22	436	120	81
Mississippi.....	193	45	55	75	18	60	122	265	378
Arkansas.....	16	9	12	24	9	25	<sup>2</sup> 21	155	42
Louisiana.....	6	63	3	6	22	14	<sup>2</sup> 175	221	18
Oklahoma <sup>2</sup> .....	8	23	10	6	33	42	46	123	49
Texas.....		69			83			135	
Montana.....	34	2	54	2	22	8	62	14	58
Idaho.....	10	4	15	5	17	8	<sup>2</sup> 13	2	8
Wyoming.....	8	1	13	4	10	4	<sup>2</sup> 1	3	35
Colorado.....	51	27	50	58	29	7	58	26	170
New Mexico.....	18	8	20	25	3	3	83	17	15
Arizona.....	11	7	18	0	5	0	60	16	2
Utah <sup>1</sup> .....									
Nevada.....	0	1	27	0	2	0	<sup>2</sup> 6	3	9
Washington.....	99	24	87	52	43	60	158	19	321
Oregon.....	44	10	44	83	21	49	46	18	56
California.....	316	233	936	326	210	43	1,023	87	820

<sup>1</sup> Reports received weekly.<sup>2</sup> Pulmonary.<sup>3</sup> Exclusive of Oklahoma City and Tulsa.

## Case Rates per 100,000 Population (Annual Basis) for the Month of July, 1931

State	Chicken pox	Diph- theria	Mea- sles	Mumps	Scarlet fever	Small- pox	Tuber- cu- losis	Ty- phoid and para- typhoid fever	Whoop- ing cough
Maine.....	66	12	94	81	51	0	79	6	81
New Hampshire.....		5			30	0		5	
Vermont.....	111	3	363	140	114	140	69	0	243
Massachusetts.....	101	46	264	74	132	0	184	10	142
Rhode Island.....	12	51	638	95	79	0	101	2	73
Connecticut.....	63	27	295	54	47	0	105	8	233
New York.....	84	36	335	61	63	3	149	8	186
New Jersey.....	92	26	219	37	69	0	129	6	436
Pennsylvania.....	84	28	305	77	88	0	88	11	177
Ohio.....	50	13	188	74	51	18	110	14	
Indiana.....	15	16	98	5	42	57	82	8	121
Illinois.....	55	45	270	42	67	19	146	12	207
Michigan.....	81	22	128	52	109	9	114	4	324
Wisconsin.....	199	14	424	313	49	6	89	9	336
Minnesota.....	52	7	77		40	2	157	5	84
Iowa.....	22	5	18	14	31	52	17	3	54
Missouri.....	9	18	33	12	26	9	82	32	171
North Dakota.....	14	26	45	17	29	62	21	3	53
South Dakota.....	34	22	10	13	37	13	44	29	61
Nebraska.....	39	8	3	67	13	23	26	8	31
Kansas.....	21	19	37	93	34	42	62	26	91
Delaware.....			470	15			64		191
Maryland.....	51	26	218	41	51	1	218	45	306
District of Columbia.....	57	64	91		57	0	201	14	332
Virginia.....	34	22	113		34	6	82	121	236
West Virginia.....	19	9	157		19	5	33	49	166
North Carolina.....	15	22	186		30	0		85	266
South Carolina.....	38	28	116	36	5	1	85	238	142
Georgia.....	8	6	28	16	17		62	102	20
Florida.....	4	21	50	7	9	0	49	30	32
Kentucky <sup>1</sup> .....									
Tennessee.....	8	5	70	8	19	12	71	88	96
Alabama.....	5	15	50	9	17	10	191	53	36
Mississippi.....	112	26	32	43	10	35	71	153	219
Arkansas.....	10	6	8	15	6	16	13	96	26
Louisiana.....	3	35	2	3	12	8	96	122	10
Oklahoma <sup>2</sup> .....	4	13	6	3	19	24	26	69	28
Texas.....		14			16			27	
Montana.....	74	4	118	4	48	18	136	31	127
Idaho.....	26	11	40	13	45	21	34	5	21
Wyoming.....	41	5	67	21	51	21	5	15	180
Colorado.....	57	30	56	65	33	8	65	29	191
New Mexico.....	49	22	55	68	8	8	227	46	41
Arizona.....	29	18	47	0	13	0	158	42	5
Utah <sup>1</sup> .....									
Nevada.....	0	13	343	0	25	0	76	38	114
Washington.....	73	18	64	39	32	44	117	14	238
Oregon.....	53	12	53	100	25	59	56	22	68
California.....	63	46	185	64	42	9	202	17	163

<sup>1</sup> Reports received weekly.<sup>2</sup> Pulmonary.<sup>3</sup> Exclusive of Oklahoma City and Tulsa.

## GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

The 94 cities reporting cases used in the following table are situated in all parts of the country and have an estimated aggregate population of more than 33,170,000. The estimated population of the 88 cities reporting deaths is more than 31,705,000. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

## Weeks ended October 31, 1931, and November 1, 1930

	1931	1930	Esti- mated ex- pectancy		1931	1930	Esti- mated ex- pectancy
<i>Cases reported</i>				<i>Cases reported—Con,</i>			
Diphtheria:				Smallpox:			
46 States.....	2, 503	1, 795	-----	46 States.....	164	252	-----
94 cities.....	542	561	865	94 cities.....	7	20	13
Measles:				Typhoid fever:			
45 States.....	1, 048	1, 499	-----	46 States.....	770	697	-----
94 cities.....	236	347	-----	94 cities.....	101	87	89
Meningococcus meningi- tis:				<i>Deaths reported</i>			
46 States.....	53	92	-----	Influenza and pneumo- nia:			
94 cities.....	22	34	-----	88 cities.....	529	642	-----
Poliomyelitis:				Smallpox:			
46 States.....	381	505	-----	88 cities.....	0	0	-----
Scarlet fever:							
46 States.....	3, 208	2, 983	-----				
94 cities.....	890	1, 011	759				

## City reports for week ended October 31, 1931

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence the number of cases of the disease under consideration that may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding weeks of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded, and the estimated expectancy is the mean number of cases reported for the week during nonepidemic years.

If the reports have not been received for the full nine years, data are used for as many years as possible, but no year earlier than 1922 is included. In obtaining the estimated expectancy, the figures are smoothed when necessary to avoid abrupt deviation from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneu- monia, deaths reported
		Cases, estimated expect- ancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND								
Maine:								
Portland	1	1	0		0	1	0	4
New Hampshire:								
Concord	0	0	0		0	0	0	1
Nashua	0	1	0		0	0	0	0
Vermont:								
Barre	0	0	0		0	0	0	0
Burlington	1	1	0		0	4	0	0
Massachusetts:								
Boston	10	24	12	5	1	4	8	15
Fall River	5	3	4		0	2	1	3
Springfield	2	4	1		0	1	2	0
Worcester	2	6	0	1	0	1	57	4
Rhode Island:								
Pawtucket	0	0	1		0	0	0	0
Providence	5	7	7		0	39	3	6
Connecticut:								
Bridgeport	0	4	0	1	0	0	0	1
Hartford		4						
New Haven	0	1	0		1	0	0	1
MIDDLE ATLANTIC								
New York:								
Buffalo	19	11	6		0	1	4	13
New York	32	116	54	20	5	17	22	118
Rochester	1	3	1		0	2	2	2
Syracuse	5	2	0		0	3	0	3
New Jersey:								
Camden	0	7	2		0	1	0	2
Newark	8	13	3	5	0	1	1	6
Trenton	1	2	1		0	0	6	1



## City reports for week ended October 31, 1931—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
<b>MIDDLE ATLANTIC—continued</b>								
Pennsylvania:								
Philadelphia.....	12	52	11	1	4	5	5	33
Philadelphia.....	46	23	13	1	1	37	35	36
Pittsburgh.....	10	2	0		0	0	0	1
Reading.....								
<b>EAST NORTH CENTRAL</b>								
Ohio:								
Cincinnati.....	5	11	4		2	0	0	9
Cleveland.....	47	34	4	4	0	10	36	7
Columbus.....	5	4	30		1	1	1	4
Toledo.....	20	8	5	2	2	0	1	5
Indiana:								
Fort Wayne.....	0	3	3		0	0	0	0
Indianapolis.....	28	11	7		2	1	19	8
South Bend.....	1	2	0		1	0	0	1
Terre Haute.....	3	2	4		0	0	0	0
Illinois:								
Chicago.....	36	100	48	6	3	10	3	53
Springfield.....	0	1	1		0	2	0	2
Michigan:								
Detroit.....	28	59	33		1	1	5	10
Flint.....	4	3	0		0	1	4	2
Grand Rapids.....	3	2	0		0	0	4	3
Wisconsin:								
Kenosha.....	6	1	0		0	1	1	0
Madison.....	0	1	3			0	6	
Milwaukee.....	35	13	1		0	2	23	3
Racine.....	4	2	0		0	0	5	0
Superior.....	1	0	0		0	0	8	2
<b>WEST NORTH CENTRAL</b>								
Minnesota:								
Duluth.....	1	0	0		0	0	1	0
Minneapolis.....	35	27	7		0	3	13	4
St. Paul.....	16	9	1		0	0	0	4
Iowa:								
Davenport.....	7	2	0			0	0	
Des Moines.....	0	2	1			0	0	
Sioux City.....		2						
Waterloo.....	3	0	0			1	0	
Missouri:								
Kansas City.....	3	8	9		0	0	1	5
St. Joseph.....	0	1	12		0	0	0	0
St. Louis.....	10	39	29			2	1	5
North Dakota:								
Fargo.....	0	0	0		0	0	1	0
Grand Forks.....	0	0	0			0	0	
South Dakota:								
Aberdeen.....	14	0	0			31	0	
Sioux Falls.....	0	0	0			0	0	
Nebraska:								
Omaha.....	23	12	15		0	0	2	3
Kansas:								
Topeka.....	4	2	5		0	0	0	1
Wichita.....	6	2	8		0	0	2	3
<b>SOUTH ATLANTIC</b>								
Delaware:								
Wilmington.....	0	1	0		0	0	0	2
Maryland:								
Baltimore.....	5	21	12	4	1	1	3	13
Cumberland.....	1	1	0		0	2	0	0
Frederick.....	0	0	0		0	0	0	0
District of Columbia:								
Washington.....	0	15	9		0	2	0	15
Virginia:								
Lynchburg.....	1	4	2		0	0	0	0
Norfolk.....	0	3	4	1	0	0	1	1
Richmond.....	0	22	14		0	0	0	4
Roanoke.....	0	4	11		0	0	0	0
West Virginia:								
Charleston.....	4	2	5		0	0	0	0
Wheeling.....	6	1	0		0	0	0	2
North Carolina:								
Raleigh.....		4						
Wilmington.....	0	1	2		0	0	0	1
Winston-Salem.....	0	6	7	1	0	0	4	2

## City reports for week ended October 31, 1931—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expect- ancy	Cases reported	Cases reported	Deaths reported			
SOUTH ATLANTIC— continued								
South Carolina:								
Charleston.....	0	0	0	16	0	0	0	1
Columbia.....	1	2	1	-----	0	0	0	3
Greenville.....	0	2	2	-----	0	0	0	0
Georgia:								
Atlanta.....	0	10	6	5	1	0	0	11
Brunswick.....	0	1	0	-----	0	0	1	1
Savannah.....	2	2	1	20	0	1	0	1
Florida:								
Miami.....	0	1	2	-----	0	25	6	0
Tampa.....	0	2	4	-----	0	0	0	0
EAST SOUTH CENTRAL								
Kentucky:								
Covington.....	2	1	1	-----	0	0	0	5
Tennessee:								
Memphis.....	0	10	14	-----	0	1	0	6
Nashville.....	1	3	6	-----	0	0	0	2
Alabama:								
Birmingham.....	0	7	10	-----	0	0	0	2
Mobile.....	0	2	1	-----	1	0	0	1
Montgomery.....	0	3	3	-----	-----	3	5	-----
WEST SOUTH CENTRAL								
Arkansas:								
Fort Smith.....	0	1	4	-----	-----	0	0	-----
Little Rock.....	0	1	3	-----	0	0	0	4
Louisiana:								
New Orleans.....	0	11	10	-----	0	0	0	7
Shreveport.....	0	1	2	-----	0	5	0	3
Oklahoma:								
Muskogee.....	0	6	2	-----	0	0	1	0
Oklahoma City.....	0	5	14	-----	0	0	0	1
Texas:								
Dallas.....	3	19	18	-----	0	0	0	4
Fort Worth.....	0	8	8	-----	0	0	0	0
Galveston.....	0	1	2	-----	0	0	0	1
Houston.....	0	7	8	-----	0	0	0	5
San Antonio.....	0	3	1	-----	0	0	0	1
MOUNTAIN								
Montana:								
Billings.....	0	0	0	-----	0	1	6	0
Great Falls.....	0	0	0	-----	0	0	0	1
Helena.....	0	0	0	-----	0	3	0	0
Missoula.....	0	1	0	-----	0	1	0	0
Idaho:								
Boise.....	-----	0	-----	-----	-----	-----	-----	-----
Colorado:								
Denver.....	14	9	1	-----	2	1	4	5
Pueblo.....	0	1	0	-----	0	0	0	0
New Mexico:								
Albuquerque.....	2	0	2	-----	0	0	0	0
Arizona:								
Phoenix.....	0	0	5	-----	0	0	0	4
Utah:								
Salt Lake City.....	23	3	0	-----	0	1	2	0
Nevada:								
Reno.....	0	0	0	-----	0	0	0	0
PACIFIC								
Washington:								
Seattle.....	58	5	1	-----	-----	28	6	-----
Spokane.....	2	2	1	-----	-----	0	0	-----
Tacoma.....	4	4	5	-----	0	0	0	0
Oregon:								
Portland.....	24	8	0	1	0	5	10	8
Salem.....	0	0	0	2	0	0	0	0
California:								
Los Angeles.....	15	31	36	30	0	5	5	7
Sacramento.....	0	2	3	-----	0	24	0	3
San Francisco.....	29	13	1	7	1	7	2	9

## City reports for week ended October 31, 1931—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuber- culo- sis, deaths re- ported	Typhoid fever			Whoop- ing cough, cases re- ported	Deaths, all causes
	Cases, esti- mated expect- ancy	Cases re- ported	Cases, esti- mated expect- ancy	Cases re- ported	Deaths re- ported		Cases, esti- mated expect- ancy	Cases re- ported	Deaths re- ported		
NEW ENGLAND											
Maine:											
Portland.....	2	1	0	0	0	0	0	1	0	2	25
New Hampshire:											
Concord.....	1	0	0	0	0	0	0	0	0	0	10
Nashua.....	0	0	0	0	0	0	0	0	0	0	-----
Vermont:											
Barre.....	0	0	0	0	0	1	0	0	0	0	4
Burlington.....	0	0	0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston.....	40	27	0	0	0	13	2	1	0	12	216
Fall River.....	2	1	0	0	0	0	0	0	0	0	17
Springfield.....	4	3	0	0	0	1	0	0	0	0	30
Worcester.....	9	16	0	0	0	0	0	0	0	10	46
Rhode Island:											
Pawtucket.....	1	0	0	0	0	0	0	0	0	0	12
Providence.....	6	6	0	0	0	4	1	0	0	2	52
Connecticut:											
Bridgeport.....	5	2	0	0	0	1	1	0	0	0	25
Hartford.....	3	-----	0	-----	-----	-----	0	-----	-----	-----	-----
New Haven.....	2	3	0	0	0	1	0	0	0	2	54
MIDDLE ATLANTIC											
New York:											
Buffalo.....	16	25	0	0	0	13	1	0	1	15	122
New York.....	62	67	0	0	0	95	18	15	3	116	1,415
Rochester.....	4	27	0	0	0	1	1	0	0	2	66
Syracuse.....	4	4	0	0	0	0	0	0	0	11	45
New Jersey:											
Camden.....	2	11	0	0	0	3	0	0	0	1	33
Newark.....	8	13	0	0	0	13	2	0	0	66	100
Trenton.....	1	3	0	0	0	1	1	0	0	1	45
Pennsylvania:											
Philadelphia.....	45	52	0	0	0	28	7	4	1	156	430
Pittsburgh.....	33	51	0	0	0	11	1	6	1	16	200
Reading.....	1	0	0	0	0	0	0	0	0	0	25
EAST NORTH CENTRAL											
Ohio:											
Cincinnati.....	14	41	0	0	0	9	0	3	0	5	123
Cleveland.....	21	32	0	0	0	9	1	16	2	96	156
Columbus.....	8	17	0	0	0	2	2	1	0	0	78
Toledo.....	9	9	1	1	0	1	1	0	0	23	58
Indiana:											
Fort Wayne.....	1	0	1	0	0	2	1	1	0	0	26
Indianapolis.....	12	5	1	1	0	2	1	1	0	4	-----
South Bend.....	3	1	0	0	0	1	0	0	0	0	14
Terre Haute.....	2	1	0	0	0	0	1	0	0	1	19
Illinois:											
Chicago.....	74	80	1	0	0	40	4	1	0	111	620
Springfield.....	2	6	0	0	0	0	0	0	0	4	20
Michigan:											
Detroit.....	61	38	1	0	0	17	2	1	0	69	243
Flint.....	10	6	0	0	0	0	0	2	0	1	13
Grand Rapids.....	8	4	0	0	0	1	0	0	0	3	26
Wisconsin:											
Kenosha.....	2	4	0	0	0	0	1	0	0	0	5
Madison.....	3	0	1	0	-----	-----	0	0	-----	1	-----
Milwaukee.....	15	16	0	0	0	3	0	0	0	91	73
Eacine.....	2	5	0	0	0	0	0	0	0	5	11
Superior.....	2	0	0	0	0	0	0	0	0	0	9
WEST NORTH CENTRAL											
Minnesota:											
Duluth.....	8	0	0	0	0	0	0	0	0	0	17
Minneapolis.....	34	6	0	0	0	2	1	0	0	7	97
St. Paul.....	16	6	1	0	0	2	0	2	0	3	53
Iowa:											
Davenport.....	0	1	0	1	-----	-----	0	0	-----	0	-----
Des Moines.....	6	5	0	0	-----	-----	0	0	-----	0	29
Sioux City.....	2	-----	0	-----	-----	-----	0	-----	-----	-----	-----
Waterloo.....	3	0	0	0	-----	-----	0	1	-----	11	-----

## City reports for week ended October 31, 1931—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuber- cul- osis, deaths re- ported	Typhoid fever			Whoop- ing cough, cases re- ported	Deaths, all causes
	Cases, esti- mated expect- ancy	Cases re- ported	Cases, esti- mated expect- ancy	Cases re- ported	Deaths re- ported		Cases, esti- mated expect- ancy	Cases re- ported	Deaths re- ported		
WEST NORTH CENTRAL—contd.											
Missouri:											
Kansas City.....	11	21	0	0	0	6	1	1	0	8	80
St. Joseph.....	2	3	1	0	0	0	0	0	0	0	-----
St. Louis.....	31	14	0	0	0	12	4	5	0	38	190
North Dakota:											
Fargo.....	2	7	0	0	0	0	0	0	0	4	-----
Grand Forks.....	2	0	0	0	-----	-----	0	0	-----	0	-----
South Dakota:											
Aberdeen.....	1	1	0	0	-----	-----	0	0	-----	8	-----
Sioux Falls.....	2	-----	0	-----	-----	-----	0	-----	-----	0	7
Nebraska:											
Omaha.....	4	6	0	0	0	1	0	1	0	1	52
Kansas:											
Topeka.....	4	1	0	0	0	0	1	0	0	1	8
Wichita.....	4	6	1	0	0	1	0	0	0	0	32
SOUTH ATLANTIC											
Delaware:											
Wilmington.....	3	4	0	0	0	0	0	2	2	3	26
Maryland:											
Baltimore.....	13	7	0	0	0	17	5	6	1	98	205
Cumberland.....	0	2	0	0	0	0	0	0	0	0	13
Frederick.....	0	0	0	0	0	0	0	0	0	0	3
District of Columbia:											
Washington.....	15	11	0	0	0	11	2	3	2	13	160
Virginia:											
Lynchburg.....	1	0	0	0	0	0	1	1	0	0	10
Norfolk.....	2	2	0	0	0	2	0	0	0	0	-----
Richmond.....	9	27	0	0	0	5	1	0	0	1	39
Roanoke.....	3	3	0	0	0	3	1	3	2	0	16
West Virginia:											
Charleston.....	2	3	0	0	0	0	1	0	0	1	14
Wheeling.....	2	3	0	0	0	1	0	0	0	0	20
North Carolina:											
Raleigh.....	1	-----	0	-----	-----	-----	0	-----	-----	-----	-----
Wilmington.....	1	2	0	0	0	1	0	0	0	6	13
Winston-Salem.....	3	2	0	0	0	2	0	0	0	9	16
South Carolina:											
Charleston.....	1	0	0	0	0	0	1	2	0	0	25
Columbia.....	1	4	0	0	0	1	0	0	0	1	25
Greenville.....	0	0	0	0	0	0	0	0	0	0	-----
Georgia:											
Atlanta.....	8	6	0	0	0	2	1	2	1	0	66
Brunswick.....	0	0	0	0	0	0	0	0	0	0	4
Savannah.....	0	4	0	0	0	2	1	0	0	6	25
Florida:											
Miami.....	1	0	0	0	0	3	1	0	0	0	19
Tampa.....	0	0	0	0	0	1	0	0	0	3	22
EAST SOUTH CENTRAL											
Kentucky:											
Covington.....	2	3	0	0	0	0	0	0	0	1	20
Tennessee:											
Memphis.....	6	15	0	0	0	5	3	1	0	14	81
Nashville.....	2	3	0	0	0	2	2	0	0	3	52
Alabama:											
Birmingham.....	5	11	0	0	0	3	2	0	0	0	42
Mobile.....	1	0	0	0	0	1	0	0	0	0	24
Montgomery.....	0	2	0	0	-----	-----	0	0	-----	0	-----
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith.....	0	1	0	0	-----	-----	0	0	-----	3	-----
Little Rock.....	2	5	0	0	0	2	1	0	0	0	6
Louisiana:											
New Orleans.....	5	0	0	0	0	9	2	5	1	4	122
Shreveport.....	0	2	0	0	0	2	0	0	0	3	35
Oklahoma:											
Muskogee.....	1	3	0	0	0	0	0	2	0	0	-----
Oklahoma City.....	2	0	0	0	0	1	1	4	0	0	30

## City reports for week ended October 31, 1931—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths, all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST SOUTH CENTRAL—contd.											
Texas:											
Dallas.....	6	4	0	0	0	2	1	0	0	7	59
Fort Worth.....	1	10	0	0	0	0	0	0	0	0	29
Galveston.....	0	0	0	0	0	0	0	0	0	0	10
Houston.....	2	2	1	0	0	3	0	0	0	0	59
San Antonio.....	1	0	0	0	0	4	1	0	0	0	49
MOUNTAIN											
Montana:											
Billings.....	0	0	0	0	0	0	0	0	0	0	4
Great Falls.....	1	2	0	0	0	0	0	0	0	2	9
Helena.....	0	0	0	0	0	0	0	0	0	0	7
Missoula.....	0	0	0	0	0	0	0	0	0	0	5
Idaho:											
Boise.....	0		0				0				
Colorado:											
Denver.....	10	14	0	0	0	8	1	0	1	10	72
Pueblo.....	1	0	0	0	0	0	1	0	0	0	3
New Mexico:											
Albuquerque.....	1	1	0	0	0	3	0	0	0	0	8
Arizona:											
Phoenix.....	1	0	0	0	0	1	0	0	0	0	
Utah:											
Salt Lake City.....	2	3	0	0	0	1	2	0	0	1	20
Nevada:											
Reno.....	0	0	0	0	0	0	0	0	0	0	7
PACIFIC											
Washington:											
Seattle.....	8	9	1	0			1	3		0	
Spokane.....	5	0	1	0			1	0		0	
Tacoma.....	3	1	2	0	0	0	0	0	0	4	25
Oregon:											
Portland.....	6	4	3	1	0	1	0	0	0	4	67
Salem.....	1	0	0	1	0	0	0	1	0	0	
California:											
Los Angeles.....	18	57	0	0	0	18	2	5	1	11	230
Sacramento.....	3	0	0	0	0	2	0	3	0	0	25
San Francisco.....	10	1	1	6	0	12	1	2	0	1	170

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
<b>NEW ENGLAND</b>									
<b>Maine:</b>									
Portland.....	0	0	0	0	0	0	0	12	0
<b>Massachusetts:</b>									
Boston.....	1	0	1	0	0	0	2	12	2
Fall River.....	0	0	0	0	0	0	0	1	0
Springfield.....	0	0	0	0	0	0	0	2	0
Worcester.....	0	0	0	0	0	0	0	5	0
<b>Rhode Island:</b>									
Providence.....	0	0	0	0	0	0	1	2	0
<b>Connecticut:</b>									
Bridgeport.....	0	0	0	0	0	0	0	2	0
New Haven.....	1	0	0	0	0	0	0	3	0
<b>MIDDLE ATLANTIC</b>									
<b>New York:</b>									
New York.....	3	1	3	1	0	0	9	35	4
Rochester.....	0	0	0	0	0	0	0	1	0
<b>New Jersey:</b>									
Newark.....	0	0	0	0	0	0	0	5	0
<b>Pennsylvania:</b>									
Philadelphia.....	1	0	0	0	0	0	1	6	2
Pittsburgh.....	0	1	0	0	0	0	0	1	0

1 Delayed report.

## City reports for week ended October 31, 1931—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
<b>EAST NORTH CENTRAL</b>									
Ohio:									
Cincinnati.....	1	1	0	0	0	0	0	0	0
Cleveland.....	1	1	0	0	0	1	1	1	0
Indiana:									
Indianapolis.....	1	0	0	0	0	0	0	0	0
Illinois:									
Chicago.....	2	1	0	0	0	0	3	7	1
Michigan:									
Detroit.....	4	0	0	0	0	0	2	3	0
Grand Rapids.....	0	0	0	0	0	0	0	1	0
Wisconsin:									
Milwaukee.....	0	0	0	0	0	0	0	1	0
Superior.....	0	0	1	0	0	0	0	1	0
<b>WEST NORTH CENTRAL</b>									
Minnesota:									
Duluth.....	0	0	0	0	0	0	0	1	1
Minneapolis.....	0	0	0	0	0	0	1	12	2
St. Paul.....	0	0	0	0	0	0	1	8	0
Missouri:									
St. Louis.....	0	0	0	0	0	0	0	1	0
North Dakota:									
Fargo.....	0	0	0	0	0	0	0	1	0
<b>SOUTH ATLANTIC</b>									
Maryland:									
Baltimore.....	2	0	0	0	0	0	2	0	0
District of Columbia:									
Washington.....	0	0	0	0	1	1	1	1	0
Virginia:									
Lynchburg.....	0	0	0	0	0	0	0	1	0
South Carolina:									
Charleston.....	0	0	0	0	3	0	0	0	0
Georgia:									
Atlanta.....	0	0	0	0	1	1	0	0	0
Savannah *.....	0	0	0	0	4	0	0	0	0
Florida:									
Miami.....	0	0	0	0	1	0	0	0	0
<b>EAST SOUTH CENTRAL</b>									
Tennessee:									
Memphis.....	0	0	0	0	0	1	0	1	0
Nashville.....	0	1	0	0	0	0	0	0	0
<b>WEST SOUTH CENTRAL</b>									
Louisiana:									
New Orleans.....	0	0	0	0	2	1	0	0	0
Oklahoma:									
Oklahoma City.....	0	1	0	0	0	0	0	0	0
Texas:									
Dallas *.....	0	0	0	0	1	0	1	0	0
Fort Worth.....	0	0	0	0	0	2	0	0	0
<b>MOUNTAIN</b>									
Colorado:									
Denver.....	0	0	0	0	0	0	1	1	0
Arizona:									
Phoenix.....	0	0	0	0	0	0	0	1	0
<b>PACIFIC</b>									
Washington:									
Tacoma.....	0	0	0	0	0	0	0	1	0
California:									
San Francisco.....	5	2	0	0	0	0	0	2	0

\* Typhus fever, 5 cases: 4 cases at Savannah, Ga., and 1 case at Dallas, Tex.

The following table gives the rates per 100,000 population for 98 cities for the 5-week period ended October 31, 1931, compared with those for a like period ended November 1, 1930. The population figures used in computing the rates are estimated mid-year populations for 1930 and 1931, respectively, derived from the 1930 census. The 98 cities reporting cases have an estimated aggregate population of more than 33,000,000. The 91 cities reporting deaths have more than 31,500,000 estimated population.

*Summary of weekly reports from cities, September 27 to October 31, 1931.—Annual rates per 100,000 population compared with rates for the corresponding period of 1930*<sup>1</sup>

## DIPHTHERIA CASE RATES

	Week ended—									
	Oct. 3, 1931	Oct. 4, 1930	Oct. 10, 1931	Oct. 11, 1930	Oct. 17, 1931	Oct. 18, 1930	Oct. 24, 1931	Oct. 25, 1930	Oct. 31, 1931	Nov. 1, 1930
98 cities.....	56	60	65	70	70	70	82	77	85	90
New England.....	50	53	72	58	46	70	87	106	65	92
Middle Atlantic.....	25	40	40	40	34	33	32	34	41	44
East North Central.....	44	79	53	99	61	91	75	105	82	130
West North Central.....	90	60	99	68	128	76	145	66	169	98
South Atlantic.....	150	68	132	116	170	100	223	106	148	116
East South Central.....	140	102	221	96	233	143	122	179	204	293
West South Central.....	108	104	74	59	101	118	142	80	162	101
Mountain.....	78	9	36	44	52	18	35	62	9	35
Pacific.....	41	51	47	81	47	87	76	101	92	67

## MEASLES CASE RATES

	18	19	29	22	26	35	32	36	37	59
98 cities.....	18	19	29	22	26	35	32	36	37	59
New England.....	24	36	137	34	70	48	180	75	125	138
Middle Atlantic.....	12	12	15	15	20	22	19	29	30	27
East North Central.....	12	5	13	11	13	14	18	16	18	18
West North Central.....	10	70	2	77	10	143	6	143	12	294
South Atlantic.....	2	22	6	12	14	8	10	14	12	20
East South Central.....	29	0	0	18	0	6	17	24	23	42
West South Central.....	17	7	27	0	10	3	24	3	17	0
Mountain.....	35	70	52	115	78	194	17	141	63	414
Pacific.....	78	22	106	20	96	57	69	18	125	24

## SCARLET FEVER CASE RATES

	65	71	99	95	101	120	127	121	140	161
98 cities.....	65	71	99	95	101	120	127	121	140	161
New England.....	132	80	144	116	137	162	195	157	154	213
Middle Atlantic.....	51	46	76	51	74	85	100	78	127	132
East North Central.....	62	106	112	135	139	177	142	171	161	218
West North Central.....	94	72	86	93	94	116	119	116	138	163
South Atlantic.....	59	76	142	126	124	126	156	162	156	166
East South Central.....	70	66	233	161	70	132	145	149	198	245
West South Central.....	37	35	61	35	41	73	57	70	47	66
Mountain.....	96	115	139	291	44	238	174	167	172	344
Pacific.....	72	73	67	75	110	51	141	89	133	47

<sup>1</sup> The figures given in this table are rates per 100,000 population, annual basis, and not the number of cases reported. Populations used are estimated as of July 1, 1931, and 1930, respectively.

<sup>2</sup> South Bend, Ind., not included.

<sup>3</sup> Hartford, Conn., Sioux City, Iowa, Raleigh, N. C., and Boise, Idaho, not included.

<sup>4</sup> Hartford, Conn., not included.

<sup>5</sup> Sioux City, Iowa, not included.

<sup>6</sup> Raleigh, N. C., not included.

<sup>7</sup> Boise, Idaho, not included.

*Summary of weekly reports from cities, September 27 to October 31, 1931.—Annual rates per 100,000 population compared with rates for the corresponding period of 1930—Continued*

## SMALLPOX CASE RATES

	Week ended—									
	Oct. 3, 1931	Oct. 4, 1930	Oct. 10, 1931	Oct. 11, 1930	Oct. 17, 1931	Oct. 18, 1930	Oct. 24, 1931	Oct. 25, 1930	Oct. 31, 1931	Nov. 1, 1930
98 cities.....	0	1	1	2	1	2	2	2	1	3
New England.....	0	0	0	0	0	0	0	0	4	0
Middle Atlantic.....	0	0	0	0	0	0	0	0	0	0
East North Central.....	0	1	0	2	0	4	2	2	1	1
West North Central.....	2	0	2	6	6	0	10	0	6	19
South Atlantic.....	0	2	4	0	0	0	4	0	6	0
East South Central.....	0	0	0	0	6	0	0	0	0	0
West South Central.....	0	3	0	3	0	3	3	7	0	3
Mountain.....	0	0	0	0	9	26	0	0	7	9
Pacific.....	0	0	10	6	2	0	12	18	12	14

## TYPHOID FEVER CASE RATES

98 cities.....	21	20	20	20	18	16	22	17	16	14
New England.....	17	12	19	22	10	10	29	29	4	5
Middle Atlantic.....	21	14	15	14	16	10	24	12	11	9
East North Central.....	9	9	5	9	8	7	12	5	16	7
West North Central.....	13	14	11	10	33	15	19	8	20	14
South Atlantic.....	65	42	53	70	49	62	26	40	38	32
East South Central.....	52	60	64	42	52	42	105	84	6	102
West South Central.....	24	52	78	49	41	21	37	24	17	14
Mountain.....	26	115	35	44	9	35	17	79	7	0
Pacific.....	16	16	10	16	4	22	6	16	25	18

## INFLUENZA DEATH RATES

91 cities.....	3	2	3	5	5	5	4	5	5	9
New England.....	2	0	2	5	2	7	2	2	4	2
Middle Atlantic.....	3	2	4	6	6	4	2	6	4	9
East North Central.....	2	1	2	3	2	4	3	3	6	6
West North Central.....	12	0	0	6	0	3	3	9	0	9
South Atlantic.....	0	2	0	2	0	6	10	4	4	18
East South Central.....	6	13	6	0	6	0	13	6	6	13
West South Central.....	0	11	7	11	14	7	17	7	0	21
Mountain.....	0	18	17	9	35	9	9	9	18	18
Pacific.....	0	2	5	0	5	7	7	7	2	2

## PNEUMONIA DEATH RATES

91 cities.....	53	58	55	71	64	72	69	88	82	99
New England.....	58	44	77	70	75	87	50	99	91	104
Middle Atlantic.....	60	59	56	74	63	70	78	102	96	109
East North Central.....	35	53	35	55	45	50	51	52	63	87
West North Central.....	59	69	56	87	100	54	91	60	75	96
South Atlantic.....	61	52	79	86	87	96	67	136	112	134
East South Central.....	63	104	69	123	69	162	95	84	101	65
West South Central.....	66	71	76	110	59	82	97	125	86	103
Mountain.....	61	132	35	97	87	194	78	79	54	167
Pacific.....	53	40	55	40	65	65	55	60	46	32

<sup>1</sup> South Bend, Ind., not included.

<sup>2</sup> Hartford, Conn., Sioux City, Iowa, Raleigh, N. C., and Boise, Idaho, not included.

<sup>3</sup> Hartford, Conn., not included.

<sup>4</sup> Sioux City, Iowa, not included.

<sup>5</sup> Raleigh, N. C., not included.

<sup>6</sup> Boise, Idaho, not included.

<sup>7</sup> Hartford, Conn., Raleigh, N. C., and Boise, Idaho, not included.



## FOREIGN AND INSULAR

### CANADA

*Provinces—Communicable diseases—Week ended October 24, 1931.*—The Department of Pensions and National Health of Canada reports cases of certain communicable diseases for the week ended October 24, 1931, as follows:

Province	Cerebro-spinal fever	Dysentery	Influenza	Lethargic encephalitis	Polio-myelitis	Small-pox	Typhoid fever
Prince Edward Island <sup>1</sup> .....							
Nova Scotia.....			7		1		6
New Brunswick.....					2		2
Quebec Province.....	1				95		24
Ontario.....				1	8		47
Manitoba.....					1		11
Saskatchewan.....						11	4
Alberta.....					3	1	
British Columbia.....		8	6				3
Total.....	1	8	13	1	110	12	97

<sup>1</sup> No case of any disease included in the table was reported during the week.

*Quebec Province—Communicable diseases—Week ended October 24, 1931.*—The Bureau of Health of the Province of Quebec, Canada, reports cases of certain communicable diseases for the week ended October 24, 1931, as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis.....	1	Paratyphoid fever.....	1
Chicken pox.....	65	Poliomyelitis.....	95
Diphtheria.....	51	Scarlet fever.....	128
German measles.....	1	Tuberculosis.....	31
Measles.....	52	Typhoid fever.....	23
Mumps.....	12	Whooping cough.....	9
Ophthalmia neonatorum.....	2		

### CHINA

*Shansi and Shensi Provinces—Plague.*—A telegram dated November 2, 1931, states that the Public Health Administration of China has received an appeal for more medical aid for districts on the Shansi-Shensi border where bubonic plague is present. Additional physicians and medical supplies were sent.

## LATVIA

*Communicable diseases—August, 1931.*—During the month of August, 1931, cases of certain communicable diseases were reported in Latvia as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis.....	3	Poliomyelitis.....	3
Diphtheria.....	44	Puerperal fever.....	12
Erysipelas.....	35	Scarlet fever.....	32
Influenza.....	91	Tetanus.....	2
Leprosy.....	1	Trachoma.....	67
Measles.....	5	Typhoid fever.....	170
Mumps.....	44		

## TRINIDAD

*Port of Spain—Vital statistics—September, 1930, 1931.*—The following statistics for the months of September, 1930 and 1931, are taken from a report issued by the public health department of Port of Spain, Trinidad:

	1930	1931		1930	1931
Number of births.....	168	153	Death rate per 1,000 population...	18.6	18.2
Birth rate per 1,000 population....	30.4	27.1	Deaths under 1 year.....	15	29
Number of deaths.....	103	103	Deaths under 1 year per 1,000 births..	89.3	180.5

## YUGOSLAVIA

*Communicable diseases—September, 1931.*—During the month of September, 1931, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax.....	146	15	Poliomyelitis.....	1	-----
Cerebrospinal meningitis.....	1	3	Rabies.....	1	1
Diphtheria.....	993	118	Scarlet fever.....	609	21
Dysentery.....	290	56	Sepsis.....	6	3
Erysipelas.....	227	5	Tetanus.....	26	13
Lethargic encephalitis.....	1	1	Typhoid fever.....	744	92
Measles.....	661	6	Typhus fever.....	3	1
Paratyphoid fever.....	15	-----			

## CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Hygiene, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

## CHOLERA

[C indicates cases; D, deaths; P, present]

Place	May 3-30, 1931	May 31- June 27, 1931	June 28- July 25, 1931	Week ended—														Nov. 7, 1931
				August, 1931				September, 1931				October, 1931						
				1	8	15	22	29	5	12	19	26	3	10	17	24	31	
Ceylon: Colombo.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
China:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canton.....	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Shanghai.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Swatow.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tientsin.....	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
India.....	13,604	18,001	22,074	9,848	9,817	9,492	10,734	9,894	1	1	1	1	1	1	1	1	1	1
Bombay.....	7,270	10,337	12,063	5,584	5,411	5,252	6,044	5,518	1	1	1	1	1	1	1	1	1	1
Calcutta.....	285	292	237	16	9	5	0	5	5	5	5	5	5	5	5	5	5	5
Chittagong.....	149	168	155	27	20	21	10	3	15	18	23	8	23	3	7	7	7	7
Karikal.....	12	17	15	7	7	6	6	4	2	3	6	6	12	1	1	1	1	1
Madras.....	52	9	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Moulmein.....	17	4	1	1	2	3	3	1	1	1	1	1	1	1	1	1	1	1
Nagapatam.....	2	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rangoon.....	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Viragapatam.....	4	3	5	1	4	2	2	2	1	1	1	1	1	1	1	1	1	1
India (French):	4	3	5	1	4	2	2	2	1	1	1	1	1	1	1	1	1	1
Chandernagor.....	17	8	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pondicherry.....	7	3	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

## CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

## CHOLERA—Continued

[C indicates cases; D, deaths; P, present]

Place	May 3-30, 1931	May 31- June 27, 1931	June 28- July 25, 1931	Week ended—												Nov. 7, 1931		
				August, 1931					September, 1931									
				1	8	15	22	29	5	12	19	26	3	10	17		24	31
India (Portuguese).....		1	2		1	1	1	2	25	6								
Indo-China (see also table below):			1		1	1		1	1	6								
Cochin-China—Rachgia.....																		
Prompenh.....		1	5		1				1	1								
.....		1	2						1									
Saigon and Cholon.....	104	61	14											1				
.....	70	41	7											1				
Iraq:																		
Abulkhasib.....								6										
.....								6										
Amara.....							2	22	35	8	1			2	2			
.....							1	21	30	7					1			
Amara Province.....									11	106	73	32	21	15	27	13	7	15
.....									4	67	44	29	24	14	17	10	6	8
Basra.....										54	91	77	19	29	32	38	30	9
.....										30	48	34	11	13	23	7	18	10
Basra Province.....									6	10	23	26	14	1	1	1	3	7
.....									3	7	10	9	8	1	1	1	4	
Dinwaniyah.....												1						
Dinwaniyah Province.....												15	8	14	24	22	1	
.....												11	6	5	22	10	5	
Iwaniyah.....												22						
.....												15						
Muntafiq Province.....								10	21	66	128	55	54	45	55	17	19	9
.....								8	20	42	75	38	57	28	37	10	18	6
Nasiriyah.....									22	50	16	4	4	18	7	4	7	6
.....									15	40	20	3	4	18	3	3	6	3
Suqelshuyukh.....								2										
.....								2										
Japan: Taiwan—Kelung.....	36																	2
Persia: Rafsanjan.....	14																	
Philippine Islands: 3 Provinces—																		
Capiz.....	17	4							9	9	17	49	21	5	4		7	5
.....	15	4							5	6	5	35	16	5	3		5	6



[C indicates cases; D, deaths; P, present]

[illegible]







## SMALLPOX

[C indicates cases; D, deaths; P, present]

Place	May 3-30, 1931	May 31-June 27, 1931	June 28-July 25, 1931	Week ended—																
				August, 1931					September, 1931					October, 1931						
				1	8	15	22	29	5	12	19	26	3	10	17	24	31			
Algeria:																				
Algiers.....	1	8	1																	
Constantine.....	1								1											
Belgian Congo.....	47	42																		
Bolivia.....																				
Brazil: Porto Alegre (alastrim).....	19	5	41	11	6	17		7	13	12	16	12								
British East Africa: Tanganyika.....	13	7	149	1	18			31	4	2	9									
British East Africa: Tanganyika.....			17							1	4									
British South Africa:																				
Northern Rhodesia.....			21			26														
Southern Rhodesia.....		1	2						1											
Canada:																				
Alberta.....			1	1																
British Columbia.....			2	2			3		1	1		12				1	2			
Manitoba.....		4																		
Winnipeg.....																				
Ontario.....	17	32	35	1		2	2	4		2		5	2	1	9					7
Kingston.....																				
Ottawa.....		1								1										
Sault Ste. Marie.....																				
Toronto.....	1	1								1		5	2		1					4
Quebec.....			1																	
Saskatchewan.....	48	54	42		10	6	10	8	8	12	5	1	6	3	1	11	3			
Regina.....	2											1			1					
Chile:																				
Antofagasta.....			1																	
Chancayal.....																				
China:																				
Amoy.....																				
Canton.....	6	4	2	1								1								
Foochow.....	3	3	2	1								1								
Hankow.....	2																			
Hong Kong.....	P	P	P		P		P		P		P									
Hong Kong.....	1	4	3	1		1	1													
Manchuria—																				
Harbin (see also table below).....	2																			
Kwantung—Dairen.....	3																			
Nanking.....	2	1																		
Nanking.....	P	P																		

1 An epidemic of smallpox was reported on May 18 with 716 cases and 314 deaths since the middle of April, 1931, in Mendes Province, Bolivia.

## CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

## SMALLPOX—Continued

[C indicates cases; D, deaths; P, present]

Place	May 3-30, 1931	May 31-June 27, 1931	June 28-July 25, 1931	Week ended—													
				August, 1931							September, 1931						
				1	8	15	22	29	5	12	19	26	3	10	17	24	31
China—Continued																	
Shanghai—																	
Foreigners only.....	7	11	3														
Including natives.....	7	13	3														
Tientsin.....							1	1				35	29	17	17	1	
Chosen (see table below).												5	8				
Columbia.....																	
Callao.....																	
Sania Maria.....	1																
Dutch East Indies.....										1							
Batavia and West Java.....	2																
East Java and Madura.....	1																
Eritrea.....	3		2					10									
France (see table below).								2									
Great Britain:																	
England and Wales.....	570	287	187		26	25	19	21	33		19	45	45	41	34	41	39
Bradford.....	8	5															
Leeds.....	2																
London.....	183	122	54		6	12	4	4	3	9	5	15	5	17	15	21	20
London and Great Towns.....	403	238	132		22	20	17	10	13	30	11	34	35	31	25	37	31
Sheffield.....		1	1								1	1					
Greece (see table below).																	
Honduras: Puerto Castilla.....	11,403	7,313	5,359			904	645	400	483				1				
India.....	1,849	1,704	1,382		234	213	179	120	144	108							
Basseln.....	9	6	6		1		1				2	2					
Bombay.....	4	5	6														
Calcutta.....	89	47	21		4			6			2	1					
Cochin.....	73	41	18					5			2	1					
Karachi.....	3				1	1	1	1					1	2	4		
Madras.....		2															
Nagapatam.....	8	1	2									1	1	5	6	1	
Rangoon.....	13	3	1		2	1	1	1	3				1	2	2	1	
	3	2	1					1	1		1		1	1		1	

Vizagapatam.....	C	0	6	5	3	2	3	1	1	1	2	4	---	---
India (French):	D	1	2	1	3	1	1	1	1	1	1	1	---	---
Chandernagor.....	C	7	1	3	---	---	---	---	---	---	---	---	---	---
Kartikal.....	D	6	0	4	1	3	2	2	6	---	---	0	---	---
Pondicherry Province.....	D	4	4	4	1	1	2	2	1	---	---	1	---	---
India (Portuguese).....	C	11	7	28	11	6	3	1	6	1	18	1	---	---
Indo-China (see also table below):	D	11	7	28	11	6	3	1	6	1	16	1	---	---
Phnompenh.....	D	3	---	---	---	---	---	---	---	---	---	---	---	---
Indo-China (see also table below):	D	1	---	---	---	---	---	---	---	---	---	---	---	---
Phnompenh.....	C	1	2	---	---	---	---	---	---	---	---	---	---	---
Saligon and Cholon.....	C	1	---	---	---	---	---	---	---	---	---	---	---	---
Saigon and Cholon.....	D	2	---	3	1	1	1	1	3	2	1	4	1	---
Iraq:	D	1	---	1	1	---	---	---	2	1	1	2	---	---
Baghdad.....	C	3	1	---	---	---	---	---	1	---	---	---	---	---
Basra.....	D	2	---	---	---	---	---	---	---	---	---	---	---	---
Musul Liwa.....	C	2	1	1	---	---	1	---	---	---	5	---	---	---
Ivory Coast (see table below).	C	---	---	1	---	---	---	---	---	---	---	---	---	---
Japan: Nagoya.....	C	---	---	1	---	---	---	---	---	---	---	---	---	---
Mexico (see also table below).	D	2	1	3	---	2	---	---	---	---	1	1	2	---
Jalisco (State)—Guadalajara.....	C	45	25	22	8	2	2	2	1	---	2	1	2	---
Mexico City and surrounding territory.....	D	11	13	8	1	1	---	---	1	1	1	2	1	---
Monterrey.....	C	1	1	---	---	---	---	---	---	---	---	---	---	---
Torreón.....	C	1	3	---	---	---	---	---	1	1	1	1	---	2
Vera Cruz.....	D	1	2	---	---	---	---	---	1	1	---	---	---	---
Morocco (see table below).	C	---	---	---	---	---	---	---	---	---	---	---	---	---
Netherlands: Friesland—Opsterland.....	C	3	3	18	---	---	---	---	---	---	---	---	---	11
Poland.....	C	67	48	45	17	12	8	10	21	18	17	16	6	15
Portugal: Lisbon.....	C	---	---	---	---	---	---	---	---	---	---	---	---	---
Rumania (see table below).	C	6	5	1	---	---	---	---	3	---	---	---	---	---
Siam.....	D	1	1	1	---	---	---	---	---	---	---	---	---	---
Spain.....	C	---	---	7	---	---	---	---	---	---	---	---	---	---
Straits Settlements.....	D	2	---	---	---	1	---	---	---	---	---	---	---	16
Sudan (Anglo-Egyptian).....	D	6	1	---	---	---	---	---	---	32	---	---	---	---
Syria (see table below).	C	2	---	---	---	---	---	---	6	---	---	---	---	---
Turkey (see table below).	D	2	---	---	---	---	---	---	---	---	---	---	---	---
Union of Socialist Soviet Republics (see table below).	C	---	---	---	---	---	---	---	---	---	---	---	---	---
Union of South Africa:	C	---	---	---	---	---	---	---	---	---	---	---	---	---
Cape Province.....	C	P	---	---	---	---	---	---	---	---	---	---	---	---
Natal.....	C	---	---	---	---	---	---	---	---	---	---	---	---	---
Orange Free State.....	C	P	P	P	---	---	---	---	---	---	---	---	---	---
Transvaal.....	C	P	P	P	---	---	---	---	---	---	---	---	---	---

1 Imported case.









## CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

## YELLOW FEVER—Continued

[C Indicates cases; D, deaths; P, present]

Place	May 3-30, 1931	May 31- June 27, 1931	June 28- July 25, 1931	Week ended—															Nov. 7, 1931
				August, 1931					September, 1931					October, 1931					
				1	8	15	22	29	5	12	19	26	3	10	17	24	31		
Gold Coast—Continued.																			
Kintampo.....			1																
Oda.....			1																
Tamale.....			2																
Wale Wale.....			2																
Ivory Coast:																			
Bobo Dioulasso.....			1																
Grand Bassam.....			1																
Kong Circle.....			4																
Seguela.....																			
Tahini.....							P												
Nigeria.....																			
Senegal:																			
Podor (Hinterland).....																			
St. Louis.....							1												
Thies.....							1												
Sudan (French):																			
Macina—Kayo Circle.....			4																
Togo (French): Atakpame—Anle Circle.....																			
Upper Volta:																			
Banfora.....			2																
Dedougou.....			1																
Diabakoto.....																			
Ouagadougou.....																			